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Final

Record of Decision

Site 21SBattery and Drum Disposal Area

Operable Unit No. XVIII

OU-07

Naval Weapons Station Yorktown

Yorktown, Virginia

September 2003

FINAL

RECORD OF DECISION
SITE 21-BATTERY AND DRUM DISPOSAL AREA

NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

CONTRACT TASK ORDER 0275

Prepared for:

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
Norfolk, Virginia

Under the:

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ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirements
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
cPAH	Carcinogenic Polynuclear Aromatic Hydrocarbon
CRP	Community Relations Program
CSF	Cancer Slope Factor
EE/CA	Engineering Evaluation/Cost Analysis
ESQD	Explosives Safety Quantity Distance
FFA	Federal Facility Agreement
HI	Hazard Index
HQ	Hazard Quotient
ILCR	Incremental Lifetime Cancer Risk
mg/kg	Milligrams per Kilograms
NPL	National Priorities List
NTCRA	Non-Time-Critical Removal Action
OU	Operable Unit
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PRAP	Proposed Remedial Action Plan
RA	Risk Assessment
RAB	Restoration Advisory Board
RfD	Reference Dose
RI	Remedial Investigation
ROD	Record of Decision
SVOC	Semivolatile Organic Compound
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WPNSTA	Naval Weapons Station

1.0 DECLARATION OF THE RECORD OF DECISION

1.1 Site Name and Location

Name: Site 21–Battery and Drum Disposal Area
Location: Naval Weapons Station (WPNSTA) Yorktown, Yorktown, Virginia

1.2 Statement of Basis and Purpose

This Record of Decision (ROD) documents that no further remedial action is necessary to reduce the risks posed by contaminated soil at Site 21 (the Site), designated Operable Unit (OU) XVIII, at WPNSTA Yorktown, Virginia. The no further action decision was made in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended, 42 U.S.C.§§ 9601 thru 9675 and, to the extent practicable, with the National Oil and Hazardous Substances Pollution Contingency Plan, 40 Code of Federal Regulations Part 300. Section 2.2.3 of this ROD lists the documents that contain the information supporting the no further action decision, and these documents are contained in the administrative record for WPNSTA Yorktown. The Commonwealth of Virginia concurs with the selected no further action decision.

1.3 Description of the Selected Remedy

The Navy completed a non-time-critical removal action (NTCRA) in the fall of 2002, which removed contaminated soil exceeding remediation levels at Site 21. Confirmation sampling determined that Site 21 poses no threat to human health or the environment. Therefore, no further remedial action is necessary for this site. The remediation of the soil at Site 21 (OU XVIII) is part of a comprehensive environmental investigation and cleanup that is currently being performed at WPNSTA Yorktown under the CERCLA program. This ROD addresses only soil at the Site; the other OUs located at WPNSTA Yorktown are being investigated separately under its installation restoration program and will be addressed in future RODs. The groundwater is being treated as a separate OU and will be addressed on an installation-wide basis.

1.4 Statutory Determination

The selected remedy protects human health and the environment and is cost effective. The Site does not require a five-year review because no hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

F.F. Aucremanne — 9/25/03

F.F. Aucremanne, CAPT, CEC, USN
Regional Engineer
By Direction of the Commander, Navy Region, Mid-Atlantic

Date

Abraham Ferdas — 9/30/03

Abraham Ferdas, Director
Hazardous Site Cleanup Division
United States Environmental Protection Agency, Region III

Date

2.0 DECISION SUMMARY

2.1 Site Name, Location, and Description

WPNSTA Yorktown is a 10,624-acre installation located on the Virginia Peninsula in York and James City Counties and the City of Newport News (Figure 2-1). WPNSTA is bounded on the northwest by the WPNSTA Yorktown Cheatham Annex Site and the Virginia Emergency Fuel Farm; on the northeast by the York River and the Colonial National Historic Parkway; on the southwest by Route 143 and Interstate 64; and on the southeast by Route 238 and the town of Lackey.

Site 21 is approximately one acre in size and is located in close proximity to Sites 4 and 22 (Figure 2-2). The topography of Site 21 is relatively flat with elevations ranging between 30 and 45 feet above mean sea level. In the wooded areas along the southeastern portion of the Site, the topography slopes sharply down towards an unnamed drainage way with elevations changing from 30 feet to approximately 10 feet above mean seal level. The Site was used as a disposal area in the 1950s. Material dumped at the Site included: drums of various sizes, batteries, empty solvent containers, and scrap metal. A NTCRA was conducted at the Site in 1994 to remove and dispose of waste and debris.

2.2 Site History and Enforcement Activities

2.2.1 Site History

Originally named the U.S. Navy Mine Depot, WPNSTA Yorktown was established in 1918 to support the laying of mines in the North Sea during World War I. For 20 years after World War I, the depot received, reclaimed, stored, and issued mines, depth charges, and related materials. During World War II, the facility was expanded to include three additional 2,4,6-trinitrotoluene loading plants and new torpedo overhaul facilities. A research and development laboratory for experimentation with high explosives was established in 1944. In 1947, a quality evaluation laboratory was developed to monitor special tasks assigned to the facility, which included the design and development of depth charges and advanced underwater weapons. On August 7, 1959, the depot was renamed the U.S. Naval Weapons Station. Today, the primary mission of WPNSTA Yorktown is to provide ordnance, technical support, and related services to sustain the war-fighting capability of the armed forces in support of national military strategy.

Site 21, the Battery and Drum Disposal Area, was used as a land disposal area in the 1950s, during which it received an estimated 7,000 tons of waste. The landfill was backfilled three to four times a week.

Materials disposed at the Site included carbon-zinc batteries from underwater weapons, and during the site investigation, a large battery disposal area was identified in the southeast portion of the Site. In addition, construction debris, pipes, glass, concrete, bottles, cans, and drums were disposed at various locations within the Site boundary.

2.2.2 Enforcement Activities

On October 15, 1992, WPNSTA Yorktown was included on the National Priorities List (NPL). A Federal Facility Agreement (FFA) between the United States Environmental Protection Agency (USEPA) Region III, the Commonwealth of Virginia, and the Department of the Navy (the Navy) was finalized for WPNSTA Yorktown in August of 1994. The FFA applies to the investigation, development, selection, and implementation of response actions for all releases or threatened releases of hazardous substances, contaminants, hazardous wastes, hazardous constituents, or pollutants at or from WPNSTA Yorktown. No documented enforcement activities have been conducted to date at Site 21 under the FFA.

2.2.3 History of Previous Investigations and Removals

A Round One Remedial Investigation (RI) conducted at Site 21 in 1993 included a geophysical investigation to estimate the extent of buried waste material (Baker and Weston, 1993). Groundwater samples were collected from four monitoring wells, and a total of ten surface soil samples and two subsurface soil samples were also collected. Samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), inorganics, and nitramine/nitroaromatic compounds. Polynuclear aromatic hydrocarbons (PAHs) and inorganics were detected in the soil, surface water, and sediment samples.

An Engineering Evaluation/Cost Analysis (EE/CA) was conducted in 1994 to evaluate removal alternatives for removing waste and debris from Site 21 (Baker, 1994). The EE/CA recommended the excavation and disposal of contaminated soil and debris. A NTCRA was conducted during the summer of 1994. Wastes encountered during this removal action included surface debris consisting of empty drums, empty containers, and batteries. A total of 6,070 tons of batteries, 650 tons of surface debris drums, and 90 tons of affected soil were removed and disposed as non-hazardous wastes. The contents of the drums were disposed as a hazardous waste because the lead concentration exceeded the federal hazardous waste threshold. Following the removal action, the area was regraded and revegetated.

The Round Two RI report (Baker, 2000) combined the analytical results from the Round One RI, post-removal confirmation sampling (from the 1994 NTCRA), and additional surface soil, subsurface soil, groundwater, surface water, and sediment data that had been collected in 1996 to further assess the nature and extent of contamination. Based on the results of the Round Two RI, a Feasibility Study was conducted for Site 21 (Baker, 2001).

Based on recommendations in the EE/CA, the Round Two RI report, and the Feasibility Study, a second NTCRA was completed in the fall of 2002. Remediation levels were developed based on the outcome of the risk assessments performed as part of the RI, and contaminated soil presenting ecological risk was removed. There were no human health risks presented by contaminated soil at the Site. The remediation levels included the following: aluminum (24,100 milligrams per kilograms [mg/kg]), cadmium (4 mg/kg), manganese (491 mg/kg), mercury (0.24 mg/kg), thallium (0.1 mg/kg), and zinc (410 mg/kg). The human health risk assessment conducted as part of the RI did not identify carcinogenic PAHs (cPAHs) as a contaminant of concern. However, to remain consistent with Site 4, soil contaminated with cPAHs exceeding the remediation level of 1 mg/kg were removed. Contaminated soil was excavated to a depth of approximately two feet and confirmation samples were collected. Approximately 145 cubic yards of soil were removed. Excavated areas were backfilled with clean soil, topsoil was added, and the areas were seeded. This NTCRA is documented in the closeout report completed by Shaw Environmental and Infrastructure, Inc. (Shaw, 2003). Figure 2-3 shows the location of the 2002 excavation areas at Site 21.

The 2002 NTCRA complied with all Federal and Commonwealth location- and action-specific applicable or relevant and appropriate requirements (ARARs) as listed below. Chemical-specific ARARs or to-be-considered criteria were not available for soil; therefore, risk-based remediation levels were developed for contaminated soil. These remediation levels were protective of both human health and the environment.

<u>Location-Specific ARARs</u>

- Archaeological Resources Protection Act of 1979 (16 U.S.C.§ 470aa-mm) (32 CFR Part 229; 43 CFR Part 7)
- Executive Order 11990, Protection of Wetlands (40 CFR Part 6, Appendix A, excluding Sections 6(a)(2), 6(a)(4), 6(a)(6), and 6(c); 40 CFR § 6.302(a))
- Clean Water Act, Section 404 (33 U.S.C. § 1344) (40 CFR § 230.10; 40 CFR § 231 [231.1, 231.2, 231.7, 231.8])
- Virginia Wetlands Regulation (VR 450-01-0051 §§ 1-5; 4 VAC 20-390-10 to -50)

Action-Specific ARARs

- Resource Conservation and Recovery Act, Subtitle C (Hazardous Waste Management) (42 U.S.C. §§ 6921-6939e)
- Virginia Hazardous Waste Management Regulations (VR 672-10-1 et seq; 9 VAC 20-60-10 et seq.)
- Virginia Erosion and Sediment Control Regulations (VR 625-02-00 §§ 1-11; 4 VAC 50-30-1-to-110)

2.3 Highlights of Community Participation

The Proposed Remedial Action Plan (PRAP) for Site 21 was made available to the public in January of 2001. The PRAP presented to the public that the chosen alternative for the Site was to excavate contaminated soil to levels acceptable for industrial land use, dispose of excavated soils off-site, and restrict future land use accordingly. The PRAP and supporting documents can be found in the administrative record for WPNSTA Yorktown. Information for this site can be found at:

Virgil I. Grissom Public Library
366 Deshazor Drive
Newport News, VA 23506
(757) 369-3190

Additional information can be obtained from:

Mr. Channing Blackwell
Installation Restoration Program Manager
Naval Weapons Station Yorktown
Building 406, Code 950
Yorktown, VA 23691-0160
(757) 887-4086

The notice of availability of the PRAP was published in the *Daily Press* on January 21, 2001. A public comment period was held from January 21 to March 6, 2001. In addition, a public meeting was held on February 21, 2001 at the Charles E. Brown Community Building on Route 238 in Lackey, Virginia to inform interested members of the community about preferred remedial alternatives under consideration and to seek public comments. At this meeting, representatives from USEPA Region III, the Commonwealth of Virginia, and the Navy answered questions about Site 21 and the remedial alternatives available for the Site. A transcript of the public meeting is included as Appendix A. No comments beyond clarifying questions were received at the public meeting or during the public comment period.

Before preparation of a final ROD for Site 21, the Navy determined that it was feasible to excavate soil to levels that are acceptable for all land uses, which would in turn negate the need for a land use restriction at Site 21. Although a final remedy of excavation to acceptable ecological levels, coupled with off-site disposal, differs from the remedy presented in the PRAP, the difference is not fundamental and was foreseeable by the public. To hasten the speed with which the Site was cleaned up, the Navy further decided to proceed with the work as a NTCRA. The Navy informed the public of its intent to undertake the NTCRA, and the progress of the removal action, during Restoration Advisory Board (RAB) meetings that were held quarterly in 2002. The WPNSTA RAB is comprised of state and federal agency representatives, technical and business people, and members of the community at large. No negative comments were received from members of the RAB regarding the NTCRA.

2.4 Scope and Role of the Remedy

The work at Site 21 is part of the comprehensive environmental investigations and remediation being conducted under the Installation Restoration Program at WPNSTA Yorktown. WPNSTA Yorktown is a large (10,624 acres) and complex Superfund site. To allow manageable projects, the Navy divided WPNSTA into 30 sites and several site screening areas. Some sites have been further divided into OUs. There are currently 18 OUs at WPNSTA. The remedial actions for OUs I through XII, OU XIV, XVII, and XVIII have been completed; OU XVIII consisted of inorganic-contaminated soil at Site 21. OUs XIII, XV, and XVI are currently in the construction phase of the remedial action. OU XVI is scheduled for completion in FY 2004, while remedial activities for OUs XIII and XV will continue into FY 2005.

Because no unacceptable human health or environmental risks remain after the excavation of contaminated soil at Site 21, no further action is required and land use controls will not be implemented. The two NTCRAs are the final response actions for soils at Site 21.

2.5 Summary of Site Characteristics

This section addresses surface and subsurface soil contamination resulting from past disposal practices. Contamination identified in groundwater, surface water, and sediment will not be discussed in this ROD. Groundwater, surface water, and sediment will be the subject of a comprehensive groundwater ROD, which will be undertaken when all subsequent investigations are completed.

2.5.1 Surface Soil

During the Round Two RI, 19 surface soil samples were collected throughout the Site and to the south of the Site along the northeast boundary of the marsh area; the marsh area encompasses a small unnamed tributary, which leads to the east branch of Felgates Creek. Surface soil samples were analyzed for SVOCs, pesticides, PCBs, and inorganics. Surface soil samples were also analyzed for nitramines/nitroaromatic compounds (explosives) by USEPA Method SW 8330. Fourteen of 19 samples were also analyzed for VOCs.

Methylene chloride, acetone, toluene, and styrene were detected at maximum concentrations of 0.06 mg/kg, 0.007 mg/kg[1], 0.003 mg/kg[2], and 0.001 mg/kg[3], respectively. The concentrations of these VOCs did not exceed their respective USEPA Region III residential soil screening values, and therefore, they were not retained as surface soil chemicals of potential concern (COPCs) in the RI.

Maximum detected concentrations of the PAHs benzo(b)fluoranthene and benzo(a)pyrene, which are potentially carcinogenic, were above their respective USEPA Region III residential soil screening values. These compounds were retained as surface soil COPCs. Benzo(a)anthracene, chrysene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene were detected at concentrations less than their respective USEPA Region III residential soil screening values but were included as surface soil COPCs in the RI because one or more of their related carcinogenic PAHs were retained, and these compounds are known to exist together in mixtures. Acenaphthylene, di-n-butylphthalate, fluoranthene, pyrene, butylbenzylphthalate, bis(2-ethylhexyl)phthalate, and benzo(g,h,i)perylene were detected at concentrations that did not exceed USEPA Region III residential soil screening values and were not retained as surface soil COPCs in the RI.

The pesticides gamma-BHC, heptachlor, aldrin, heptachlor epoxide, 4,4'-DDE, endrin, 4,4'-DDD, 4,4'-DDT, methoxychlor, endrin ketone, alpha-chlordane, and gamma-chlordane were detected in the surface soil at concentrations below their respective USEPA Region III residential soil screening values. As a result, these pesticides were not retained as surface soil COPCs in the RI. The pesticide dieldrin was detected at concentrations that exceeded the USEPA residential contaminant of concern (COC) screening value and was, therefore, retained as a surface soil COPC.

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[1] Value is estimated.
[2] Value is estimated.
[3] Value is estimated.

The maximum detected concentrations of barium, beryllium, cobalt, copper, cyanide, lead, nickel, selenium, silver, and vanadium did not exceed corresponding USEPA Region III residential soil screening values and were not retained as surface soil COPCs. Aluminum, arsenic, cadmium, chromium, iron, manganese, mercury, thallium, and zinc were detected at concentrations greater than USEPA Region III residential soil screening values and, therefore, were retained as surface soil COPCs in the RI.

In July 2000, surface soil samples were collected throughout WPNSTA and analyzed for dioxins and dibenzofurans. Site 21 was identified as a candidate site for dioxin analysis because of the past waste disposal activities and its proximity to the former ash pile at Site 4. Two surface soil samples were collected from Site 21 in a potential depositional area downhill from the former Site 4 ash pile. Results for Site 21 dioxins were similar to base-wide background results, indicating that past disposal activities did not introduce dioxins or dibenzofurans to soil at Site 21. Both Site 21 results and WPNSTA background results were below the Agency for Toxic Substances and Disease Registry environmental media evaluation guide value of 50 parts per trillion, which indicates that the levels of dioxin detected are unlikely to cause adverse human health or environmental effects following exposure.

2.5.2 Subsurface Soil

Six subsurface soil samples were also collected from Site 21 at depths of 0.5- to 1.5-ft below ground surface (bgs) for post-removal-action confirmation analysis (confirmation sampling following the 1994 NTCRA). In addition, two subsurface soil samples were collected during the installation of monitoring well 21GW04 at depths of 0 to 2.0-ft bgs. These samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and inorganics. Subsurface soil samples were also analyzed for explosives using USEPA Method SW 8330.

Acetone, methylene chloride, and toluene were detected in the subsurface soil at concentrations below corresponding residential soil COPC screening values. Therefore, these compounds were not retained as shallow subsurface soil COPCs in the RI.

Phenol, di-n-butylphthalate, fluoranthene, pyrene, chrysene, bis(2-ethylhexyl)phthalate, benzo(b)fluoranthene, benzo(a)pyrene, and benzo(g,h,i)perylene were detected at concentrations that do not exceed USEPA Region III residential soil screening values. Therefore, these contaminants were not retained as subsurface soil COPCs.

The pesticides 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, alpha-chlordane, and gamma-chlordane and Aroclor-1260 were detected in subsurface soil samples at concentrations that do not exceed their respective USEPA Region III residential soil screening values. Therefore, pesticides and PCBs were not retained as subsurface soil COPCs at Site 21.

Maximum concentrations of arsenic, chromium, iron, and manganese were detected at concentrations greater than residential soil screening values and, therefore, were retained as subsurface soil COPCs. Maximum detected concentrations of aluminum, barium, beryllium, copper, lead, mercury, vanadium, and zinc did not exceed corresponding residential soil screening values and, therefore, were not retained as subsurface soil COPCs.

2.5.3 Summary

After COPCs were identified for surface and subsurface soil at Site 21, a site conceptual model was developed. The site conceptual model of potential exposure is presented in Figure 2-4. The model presents sources of contamination, potential release mechanisms, pathways for exposure, and potential receptors that could be affected under current site conditions.

During the fall 2002 NTCRA, confirmatory soil samples were collected from the walls and floors of the excavated areas. Soil samples were analyzed for the contaminants of concern, and none of the contaminants were detected at levels above their remediation levels. The closeout report for this removal action documents the analytical results of the confirmatory sampling (Shaw, 2003).

2.6 Current and Potential-Future Land and Resource Uses

Because the mission for WPNSTA Yorktown is to sustain war-fighting capabilities for all branches of the armed services, activities and land use at WPNSTA Yorktown are largely industrial. Site 21 is within the restricted area of the WPNSTA, and human access is limited. In addition, this site also falls within the explosives safety quantity distance (ESQD) arc, which is also a restricted area. The ESQD arc estimates the area that would be affected in the event of an uncontrolled detonation of stored munitions. The Navy prohibits development of areas falling within the ESQD arc, and a restricted area surrounding ESQD arcs, for office space or residential use.

2.7 Summary of Site Risks Before Soil Removal

Before the 2002 NTCRA, a baseline risk assessment (RA) was conducted for Site 21. A baseline RA estimates what risks the Site might pose if no action is taken, and it provides the basis for taking remedial action at the Site. Both human health and ecological RAs were conducted at Site 21, and this section provides a brief summary of these RAs and identifies the contaminants and exposure pathways that needed to be addressed by the remedial action.

Human health risks are described by evaluating noncarcinogenic (systemic) and carcinogenic health effects. Reference dose (RfD) values developed by USEPA indicate the exposure dose at which the potential for adverse noncarcinogenic health effects exists from contaminants of potential concern. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. RfDs are derived from human epidemiological data or animal studies to which uncertainty factors have been applied to account for the use of animal data to predict effects on humans. These uncertainty factors help to ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with an RfD for a similar exposure period. The ratio of exposure to the RfD is called a hazard quotient (HQ). HQ values are then summed to produce hazard indices (HIs) for each potential receptor and means of exposure (dermal, ingestion, inhalation). If an HI is greater than or equal to 1.0, the contaminants included in the HI are re-examined to see whether they affect the same target organ (e.g., liver). If they do, HIs are computed, summing HQ values only for contaminants that affect a single target organ. Contaminants that affect a single target organ and produce an HI greater than or equal to 1.0 are determined to be COCs, and remedial action is considered to reduce the risk of adverse, noncarcinogenic health effects in the exposed population.

Carcinogenic human health risks are expressed as a probability known as the incremental lifetime cancer risk (ILCR). This risk is the probability that an individual will develop cancer in his or her lifetime following exposure to a contaminant. These risks are usually expressed in scientific notation. An incremental lifetime cancer risk of $1x10^{-6}$, for example, indicates that an individual who receives an estimated reasonable maximum exposure to contaminants has one chance in a million of developing cancer as a result. This is referred to as an “incremental lifetime cancer risk” because it would be in addition to the risks of cancer that individuals face from other causes (for example, smoking). ILCR values for all potentially carcinogenic COPCs to which a person may be exposed are added together to produce a total ILCR value. The total ILCR value is compared with USEPA's acceptable risk range of $1x10^{-6}$ to $1x10^{-4}$. The acceptable risk range is the range of cancer risks considered to be acceptable at most sites under most circumstances. For example, the upper end of USEPA's acceptable risk range, $1x10^{-4}$, means that one additional cancer case is estimated to occur in an exposed population of 10,000 as a result of exposure to the Site. It can also mean that an individual with an ILCR value of $1x10^{-4}$ has an estimated increased probability of 0.01 percent of developing cancer (over the course of a lifetime) following exposure. ILCR values of $1x10^{-4}$ or greater are evaluated to identify those contaminants in environmental media responsible for 95 percent of the unacceptable risk. These chemicals are considered to be COCs and remedial action is considered to reduce the cancer risk.

Because WPNSTA Yorktown was placed on the NPL, in part, as a result of ecological concerns (proximity to wetlands, etc.), potential ecological receptors are also evaluated at each site. Terrestrial and aquatic receptors are evaluated using a weight-of-evidence approach which consists of two phases: a general comparison to existing toxicity criteria and conservative contaminant uptake modeling to establish a site-specific body burden in an animal receptor and a comparison to published toxicity data for a similar animal. Both phases of the ecological RA culminate with the calculation of ecological HQs. Ecological HQ values equal to or greater than one indicate the potential for adverse effects on the environment. Chemicals producing HQs equal to or greater than one in both phases of the weight-of-evidence approach are considered ecological COCs pending a comparison to base-wide background levels. Remediation of these contaminants must, however, be considered carefully, so that the selected remedy does not create more short-term harm to ecological receptors than would be produced by leaving contaminants in place. That is, scientists must decide if more damage will be done by removing soil, thereby altering the existing habitat, or by having contaminants remain in the soil.

2.7.1 Human Health Risk Assessment

Surface soil, subsurface soil, groundwater, surface water, and sediment were evaluated in the human health RA. Only risks associated with soil collected from Site 21 will be presented in this ROD. Groundwater, surface water, and sediment will be addressed as a separate ROD in the future.

Both current-potential and future-potential human exposure scenarios were evaluated at Site 21. Because the Site falls within the restricted area of WPNSTA Yorktown, the potential for current human exposure is limited. Site 21 is within the ESQD arc, which is associated with the storage of munitions inside the restricted area of WPNSTA Yorktown. Residential development is not permitted in this area. Current- and future-potential human receptors evaluated in the baseline human health RA for Site 21 include:

- Current Adult On-Base Trespassers
- Current Adolescent On-Base Trespassers (7 to 15 years old)
- Current Commercial/Industrial Workers
- Future Adult On-Base Residents
- Future Adolescent Resident Children (7 to 15 years old)
- Future Younger Resident Children (1 to 6 years old)
- Future Adult Construction Workers

Potential receptors were selected based on available information concerning base activities and all foreseeable potential future land-use scenarios including future residential property use at Site 21.

The current adult and adolescent trespasser scenario, although unlikely, assumes that WPNSTA personnel and adolescent children (family members) could trespass during recreational activities. The exposure potential was assumed to be 26 occurrences per year for 9 years for adolescent children. Adult trespasser exposure could occur 26 days per year for 30 years. This estimate is conservative because current property use restrictions prohibit this type of exposure at Site 21.

Potential on-base trespassers include WPNSTA personnel and family members who may access the Site for recreational purposes. Potential exposure to the contaminated media for these potential current receptors includes accidental ingestion of and dermal contact with surface soil. Total risks were estimated by site for the current potential trespassers using the concept of reasonable maximum exposure, which is the highest exposure that is reasonably expected to occur at a site and, in practice, is estimated by combining upper bound (90^{th} and 95^{th} percentile) values (USEPA, 1989).

Future residential development is unlikely at Site 21 because it falls within the restricted area of WPNSTA. However, the future on-base adult, adolescent, and young child resident scenarios were evaluated to address all types of potential exposure and to provide a conservative estimate of future human risk. Future adult and child residents were evaluated for potential exposure to surface soil by ingestion of and dermal contact with COPCs. Exposure frequency for surface soil of 350 days per year was used with durations of 24 years for the adult, 9 years for the adolescent, and 6 years for the child resident.

Commercial/industrial workers and future construction workers were also evaluated at Site 21. Future commercial/industrial workers were evaluated for potential exposure to surface soil (0 to 6 inches), and future construction workers were evaluated for potential exposure to subsurface (6 inches bgs and below) soil. An exposure frequency for soil of 250 days per year was used for all worker exposure scenarios. Exposure durations of 25 years and 1 year were used for commercial/industrial workers and construction workers, respectively.

For each exposure route and potentially exposed population, ILCR values and HI values were calculated to quantify potential risks. The following subsections present a summary of risks (i.e., ILCR values greater than $1x10^{-4}$ and HI values greater than or equal to 1.0) for potential human receptors.

Cancer Slope Factor (CSF) and RfD values used to estimate potential human health risks are presented in Table 2-1. These toxicity criteria have been extracted from the most recent USEPA databases (e.g., IRIS) and other USEPA reference material (e.g., Environmental Criteria Assessment Office or Health Effects Assessment Summary Tables). CSF and RfD values are combined with estimates of potential exposure to produce ILCR and HI values for exposed populations.

Tables 2-2 and 2-3 present the surface and subsurface soil COPCs evaluated in the human health RA for Site 21.

2.7.1.1 Current Receptors

Table 2-4 presents total ILCR and HI values for the current adult and adolescent on-base trespassers as well as current commercial/industrial workers. Carcinogenic risks for all current potential human receptors at Site 21 fall within the USEPA acceptable risk range of $lx10^{-6}$ to $1x10^{-4}$.

HI values exceed 1.0 for both adult and adolescent on-base trespassers. These exceedances were based on the cumulative effect of exposure to all noncarcinogenic constituents detected in surface soil and exposure by both dermal and ingestion pathways. Individual HQ values for each constituent were below 1.0, when evaluated by target organs, indicating that adverse systemic health effects will not occur subsequent to exposure. In addition, the HI value for a commercial/industrial worker is below 1.0. Unacceptable noncarcinogenic human health effects are not expected to occur at Site 21 under current exposure conditions.

2.7.1.2 Future Receptors

Table 2-5 presents the total ILCR and HI values for potential future residents and future construction workers at Site 21. ILCR values for each potential human receptor fall within the USEPA acceptable risk range.

The total surface soil HI estimated for the future residential adults, older children, and younger children are 1.0, 1.5, and 2.8, respectively. An evaluation of the HI derived for younger resident children indicates that the ingestion route of exposure (HI = 1.3) accounts for approximately 43 percent of the total HI value, while the dermal-contact route of exposure (HI = 1.5) accounts for the remaining 57 percent of the total. Corresponding HI values generated for future construction workers exposed to contaminants in subsurface soil fall below 1.0, suggesting that adverse health effects will not occur from exposure to COPCs from Site 21 subsurface soil by future potential receptors.

The contaminants included in the HI were re-examined for younger children because the total HI exceeds 1.0. Table 2-6 shows the breakdown of the HQs by contaminant. The individual HQ values for cadmium, chromium, iron, manganese, and mercury are below 1.0. These contaminants also affect different target organs, and individual HQ values should not be summed across target organs because the effect of exposure on one target organ or system is not related to the effect on another target organ or system. Therefore, adverse noncarcinogenic health effects are not expected from these contaminants.

2.7.2 Ecological Risk Assessment

The objective of the ecological risk assessment is to determine whether past site operations have adversely affected the ecological integrity of the terrestrial community at Site 21. A weight-of-evidence approach is used. Contaminant concentrations are first compared to published toxicity information (Phase I) and then evaluated by mathematical models to evaluate whether significant risk is posed by the contaminants to the environment (Phase II).

The ecological RA is comprised of three general sections: exposure assessment, effects assessment, and risk characterization. The following paragraphs present the ecological RA for Site 21. Because this ROD pertains to surface and subsurface soil, only those risks posed to terrestrial ecological receptors will be presented.

2.7.2.1 Exposure Assessment

Ecological receptors were identified by evaluating site conditions and by recommendations from USEPA Region III Biological Technical Assistance Team representatives. In addition to general surface soil flora and fauna, the following terrestrial ecological receptors were evaluated at Site 21:

- American Woodcock (*Scolopax minor*);
- Red-Tailed Hawk (*Buteo jamaicensis*);
- American Robin (*Turdus migratorius*);
- Bobwhite Quail (*Colinum virginianus*);
- Marsh Wren (*Cistothorus palustris*);
- Red Fox (*Vulpes vulpes*);
- Short-Tailed Shrew (*Blarina brevicauda*);
- Meadow Vole *(Microtus pennsylvanicus)*; and
- Deer Mouse (*Peromyscus maniculatus*).

There are no rare, endangered, or threatened species, as designated by the Commonwealth of Virginia or the federal government, present at Site 21. Although Site 21 lies in the Felgates Creek watershed, no surface water bodies are directly associated with this site.

Three general terrestrial habitat types are present at Site 21. These habitats include open field, shrub/mixed forest edge, and upland forest. The open field is a mix of grasses, perennial plants, scattered shrubs, and small trees. Trees dominate the older areas of shrub/mixed forest habitat. Upland forest exists in undisturbed areas surrounding Site 21 and is dominated by white oak (*Quercus alba*), tulip poplar (*Liriodendron tulipifera*), hickory (*Carya* sp.), and beech (*Fagus grandifolia*).

Complete exposure pathways for terrestrial receptors include the ingestion of surface soil, plants, and prey species that may contain concentrations of site related contaminants. To estimate the potential intake of contaminants, conservative contaminant uptake models were used that consider site use and receptor behavior. For example, 100 percent of the receptor's home range was assumed to occur at Site 21. The most conservative estimates of receptor body weight were obtained from USEPA's Wildlife Exposure Factors Handbook (USEPA, 1993a). Dietary composition information was obtained from available scientific literature for each receptor species. Food intake was estimated from data provided in the Wildlife Exposure Factors Handbook using the highest of reported body weights (USEPA, 1993a). The contaminants were assumed to be 100 percent available for uptake.

Receptor species were selected to represent different levels of the food chain. Organisms that are likely to be exposed to contaminants because of specific behaviors, patterns of habitat use, or feeding habits were selected for quantitative evaluation in this ecological RA. These species were selected because of their presence on site or their importance in the food chain or because the habitat on or near the Site can support these species.

2.7.2.2 Effects Assessment

There are two types of ecological endpoints: (1) assessment endpoints and (2) measures of effect (USEPA, 1998). Assessment endpoints are environmental characteristics that, if significantly affected by the presence of contaminants in environmental media, would indicate a need for remediation (e.g., decrease in sports/fisheries). Measures of effect may be a measure or an indication of direct toxicity (i.e., results of toxicity tests or comparisons to toxicity criteria).

Table 2-7 presents assessment endpoints, measures of effect, risk hypotheses, and receptor species selected for terrestrial assessment at Site 21.

2.7.2.3 Risk Characterization

Table 2-8 presents the ecological COPCs for Site 21. The terrestrial environment at Site 21 was adversely impacted by surface soil concentrations of PAHs, 4,4'-DDD, and inorganic constituents including aluminum, cadmium, chromium, copper, iron, manganese, mercury, thallium, vanadium, and zinc.

Conservative contaminant uptake models suggest that surface soil concentrations of aluminum, arsenic, cadmium, chromium, lead, mercury, and zinc produced HQ values above 1.0 for the American robin, the American woodcock, and the marsh wren. Aluminum, arsenic, cadmium, manganese, mercury, thallium, vanadium, and zinc also produced HQ values above 1.0 for the red fox, the bobwhite quail, the meadow vole, the short-tailed shrew, the deer mouse, and the red-tailed hawk. PAHs and 4,4'-DDD did not produce unacceptable HQ values in conservative upper-trophic-level receptor models. Upper-trophic-level models assess the animals at the top of the food chain and evaluate contaminants that may bioaccumulate. Therefore, PAHs and 4,4'-DDD were not retained as COCs for the evaluation of remedial alternatives.

Contaminant uptake models that utilize actual home range estimates (i.e., the site is only a portion of the home range) indicated potential unacceptable risks to the red fox, the American robin, the meadow vole, the short-tailed shrew, the deer mouse, the American woodcock, and the marsh wren. These unacceptable risks were posed by surface soil concentrations of aluminum, cadmium, chromium, manganese, mercury, thallium, and zinc. Aluminum, cadmium, copper, manganese, mercury, thallium, and zinc exceeded base-wide surface soil background concentrations. As a result, these inorganic elements were retained as COCs. Chromium, iron, and vanadium were not retained as COCs because the detected concentrations fell within the range of base-wide background concentrations. USEPA does not require remediation of contaminant concentrations that fall within the range of background concentrations. Copper was not retained as a COC because only one sample location of 19 exceeded the surface soil screening level for copper, indicating the low likelihood of population-level effects.

2.7.3 Summary of Baseline Risk Assessment Results

During the RI, there were no unacceptable human health risks associated with Site 21 under current- or future-potential exposure scenarios. However, aluminum, cadmium, manganese, mercury, thallium, and zinc in surface soil posed unacceptable health threats to terrestrial ecological receptors. Removal of soil at Site 21 was, therefore, necessary to protect the environment.

Remediation levels protective of terrestrial ecological receptors were developed based on the ecological risk assessment. Contaminated soil exceeding remediation levels was removed from Site 21 during the fall of 2002. Table 2-9 provides the soil remediation levels for the COCs posing unacceptable risk to ecological receptors. Carcinogenic PAHs were not identified as a COC; however, to remain consistent with Site 4, soil contaminated with cPAHs exceeding the remediation level of 1 mg/kg were removed. Confirmation sampling of soil was conducted as part of the removal; this sampling confirmed that risks to ecological receptors are no longer present at the Site.

2.8 <u>Documentation of Significant Changes</u>

The proposed plan was released for public comment in January 2001. It identified cleanup of soil contamination to industrial levels as the preferred alternative. Before preparation of a final ROD for Site 21, the Navy determined that it was feasible to excavate soil to levels that are acceptable for all land uses, which would in turn negate the need for a land use restriction at Site 21. Although a final remedy of excavation to acceptable ecological levels, coupled with off-site disposal, differs from the remedy presented in the PRAP, the difference is not fundamental and was foreseeable by the public. To hasten the speed with which the Site was cleaned up, the Navy further decided to proceed with the work as a

NTCRA. Therefore, after completion of the NTCRA and confirmatory sampling, this ROD is being issued as no further action.

3.0 RESPONSIVENESS SUMMARY

During the public comment period, written comments, concerns, and questions were solicited. A public meeting was held on February 21, 2001, at the Charles E. Brown Community Building to formally present the Draft PRAP and to answer questions and receive comments. The transcript of this meeting is presented in Appendix A of this ROD. No comments beyond clarifying questions were received at the public meeting or during the public comment period.

3.1 Overview

At the time of the public meeting on February 21, 2001, the Navy had endorsed a preferred alternative in the PRAP for the cleanup of soil contaminated with inorganics to industrial levels plus restricted land use at Site 21 at WPNSTA Yorktown. The alternative required excavation of contaminated soil at concentrations above corresponding remediation levels (Table 2-9) and the restoration of the excavated area. The excavated soil from the Site would be transported off-site to an approved disposal facility. Members of the community asked questions about this approach to which the Navy responded. During the meeting, USEPA Region III and the Commonwealth of Virginia concurred with the preferred alternative for Site 21. The community offered no comment, at the public meeting or in writing, in opposition to the selection of the preferred alternative.

Before preparation of a final ROD for Site 21, the Navy determined that it was feasible to excavate soil to levels that are acceptable for all land uses, which would in turn negate the need for a land use restriction at Site 21. To hasten the speed with which the Site was cleaned up, the Navy further decided to proceed with the work as a NTCRA. The Navy informed the public of its intent to undertake the NTCRA, and the progress of the removal action, during RAB meetings that were held quarterly in 2002. The WPNSTA RAB is comprised of state and federal agency representatives, technical and business people, and members of the community at large. No negative comments were received from members of the RAB regarding the NTCRA.

3.2 Background on Community Involvement

Nearby communities have a good working relationship with WPNSTA Yorktown because it maintains a “good neighbor” policy through the Public Affairs Office. WPNSTA Yorktown participates in community events and celebrations to foster close ties with the community. As part of the ongoing Community Relations Program (CRP), community interviews were conducted in 1991 to inform the community of the Installation Restoration Program and solicit feedback on the listing of WPNSTA Yorktown as an NPL site. During these interviews, the community expressed concern about three issues: water resources, cleanup funding, and information availability/validity. This public openness has been maintained by the Public Affairs Office and the Environmental Directorate at WPNSTA Yorktown through the CRP and resulted in the formation of the RAB. The RAB meets regularly, and progress at sites such as Site 21 is discussed from the work plan stage to selection of the remedial alternative (if necessary). Preliminary RI results for Site 21 have been discussed at RAB meetings. Removal activities at Site 21 were discussed during the September 5, 2001 RAB meeting and in 2002.

3.3 Summary of Comments Received During the Public Comment Period

The public comment period on the PRAP began on January 21, 2001 and ended on March 6, 2001. No comments were received from the public during the public comment period.

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TABLES

TABLE 2-1

HUMAN HEALTH RISK ASSESSMENT TOXICITY CRITERIA
SITE 21
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Constituent	Oral CSF $(mg/kg/day)^{-1}$	Inhal. CSF $(mg/kg/day)^{-1}$	Oral RfD (mg/kg/day)	Inhal. RfD (mg/kg/day)	Dermal Absorption Values	USEPA WOE	Target Organ/Critical Effect
SVOCs							
Benzo(a)anthracene	7.3E-01 (e)	--	--	--	50%	B2	NA/NA
Benzo(b)fluoranthene	7.3E-01 (e)	--	--	--	50%	B2	NA/NA
Benzo(a)pyrene	7.3 (i)	--	--	--	50%	B2	NA/NA
Indeno(1,2,3-cd)pyrene	7.3E-01 (e)	--	--	--	50%	B2	NA/NA
Dibenzo(a,h)anthracene	7.3 (e)	--	--	--	50%	B2	NA/NA
n-Nitroso-di-n-propylamine	7.0 (i)	--	--	--	50%	B2	NA/NA
Bis(2-ethylhexyl)phthalate	1.4E-02 (i)	14.E-02 (e)	2.0E-02 (i)	--	50%	B2	NA/NA
Pesticides							
Dieldrin	1.6E+01 (i)	1.6E+01 (i)	5.0E-05 (i)	--	50%	B2	Liver/Lesions
Inorganics							
Aluminum	--	--	1.0 (e)	1.0E-03 (e)	20%		CNS/Adverse Effects
Antimony	--	--	4.0E-04 (i)	--	20%	--	Blood/Altered Chemistry
Arsenic	1.5 (i)	15.1 (i)	3.0E-04 (i)	--	95%	A	Skin/Keratosis, Hyperpigmentation
Cadmium (water)	--	6.30 (i)	5.0E-04 (i)	--	5%	B1	Kidney/Proteinuria
Cadmium (soil)	--	6.30 (i)	1.0E-03 (i)	--	2.5%	B1	Kidney/Proteinuria
Chromium	--	41.0	3.0E-03	3.0E-05	100%	A	Stomach and Nasal

TABLE 2-1 (continued)

HUMAN HEALTH RISK ASSESSMENT TOXICITY CRITERIA
SITE 21
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Constituent	Oral CSF $(mg/kg/day)^{-1}$	Inhal. CSF $(mg/kg/day)^{-1}$	Oral RfD (mg/kg/day)	Inhal. RfD (mg/kg/day)	Dermal Absorption Values	USEPA WOE	Target Organ/Critical Effect
		(h)	(i)	(i)			Mucosa/Ulceration
Iron	--	--	3.0E-01 (e)	--	20%	D	Heart/Cardiac Dysfunction
Manganese	--	--	2.0E-02 (i)	1.43E-05 (i)	5%	D	CNS, Lung/Adverse Effects
Mercury	--	--	3.0E-04 (h)	--	15%	D	Kidney,CNS/Adverse Effects, Neurotoxicity
Thallium	--	--	7.0E-05 (o)	--	20%	--	Liver, Blood/Increased Enzymes
Zinc	--	--	3,0E-01 (i)	--	25%	D	Blood/Decreased Enzymes

Notes:

7.3E-01 = $7.3x10^{-01}$

i Integrated Risk Information System (IRIS) (USEPA, 1999a)
e Environmental Criteria and Assessment Office (USEPA, 1999b, as cited in RBC Tables)
h Health Effects Assessment Summary Tables (USEPA, 1997)
w Withdrawn from IRIS or HEAST
-- Not Available
CNS Central Nervous System
CSF Cancer Slope Factor
RfD Reference Dose
WOE Weight of Evidence for Carcinogenicity:
- A Human carcinogen
- B1 Probable human carcinogen—indicates that limited human data are available
- B2 Probable human carcinogen—indicates sufficient evidence in animals and inadequate or no evidence in humans
- C Possible human carcinogen
- D Not classifiable as a human carcinogen
- E Evidence of noncarcinogenicity

TABLE 2-2

SURFACE SOIL DATA AND COPC SELECTION SUMMARY
SITE 21
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Contaminant(1)	Region III Criteria(2)	Contaminant Frequency/Range(3)		Background (4)		Comparison to Criteria	COPC Selection
	Residential COC Value (mg/kg)	No. of Positive Detects/ No. of Samples	Range of Positive Detections (mg/kg)	No. of Positive Detects/ No. of Samples	Range of Positive Detections (mg/kg)	Positive Detects Above Residential COC Value	Selected as a COPC?
Volatiles							
Methylene Chloride	85	1/14	0.06	NA	NA	0	No
Acetone	780	1/14	0.007J	NA	NA	0	No
Toluene	1,600	3/14	0.001J-0.003J	NA	NA	0	No
Styrene	1,600	1/14	0.001J	NA	NA	0	No
Semivolatiles							
Acenaphthylene	470(5)	1/19	0.11J	NA	NA	0	No
Di-n-butylphthalate	780	3/19	0.042-0.36J	NA	NA	0	No
Fluoranthene	310	1/19	0.27J	NA	NA	0	No
Pyrene	230	2/19	0.049J-0.26J	NA	NA	0	No
Butylbenzylphthalate	1,600	7/19	0.043J-1.4	NA	NA	0	No
Benzo(a)anthracene	0.88	1/19	0.2J	NA	NA	0	Yes(6)
Chrysene	88	1/19	0.26J	NA	NA	0	Yes(6)
Bis(2-ethvlhexvl)phthalate	46	10/19	0.074J-0.26J	NA	NA	0	No
Benzo(b)fluoranthene	0.88	1/19	0.91	NA	NA	1	Yes
Benzo(k)fluoranthene	8.8	1/19	0.22J	NA	NA	0	Yes(6)
Benzo(a)pyrene	0.088	1/19	0.14J	NA	NA	1	Yes
Indeno(1,2,3-cd)pyrene	0.88	1/19	0.13J	NA	NA	0	Yes(6)
Benzo(g,h,i)perylene	230(7)	1/19	0.11J	NA	NA	0	No
Pesticides							
Gamma-BHC (Lindane)	0.49	2/19	0.013-0.022	NA	NA	0	No
Heptachlor	0.14	2/19	0.013-0.022	NA	NA	0	No
Aldrin	0.038	2/19	0.011-0.02	NA	NA	0	No
Heptachlor Epoxide	0.07	1/19	0.00034J	NA	NA	0	No

TABLE 2-2 (continued)

SURFACE SOIL DATA AND COPC SELECTION SUMMARY
SITE 21
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Contaminant[1]	Region III Criteria[2]	Contaminant Frequency/Range[3]		Background [4]		Comparison to Criteria	COPC Selection
	Residential COC Value (mg/kg)	No. of Positive Detects/ No. of Samples	Range of Positive Detections (mg/kg)	No. of Positive Detects/ No. of Samples	Range of Positive Detections (mg/kg)	Positive Detects Above Residential COC Value	Selected as a COPC?
Dieldrin	0.04	5/19	0.000085J-0.046	NA	NA	1	Yes
4,4'-DDE	1.9	9/19	0.00062J-0.039	NA	NA	0	No
Endrin	2.3	2/19	0.031-0.051	NA	NA	0	No
4,4'-DDD	2.7	3/19	0.0032J-0.19J	NA	NA	0	No
4,4'-DDT	1.9	2/19	0.0043-0.033	NA	NA	0	No
Methoxychlor	39	3/19	0.0013J-0.0028J	NA	NA	0	No
Endrin Ketone	2.3[8]	1/19	0.00095J	NA	NA	0	No
Alpha-chlordane	1.8[9]	3/19	0.0026-0.015	NA	NA	0	No
Gamma-chlordane	1.8[9]	3/19	0.003-0.013	NA	NA	0	No
Inorganics							
Aluminum	7,800	19/19	938-43,300	44/44	1,960-19,200	4	Yes
Arsenic	0.43	10/19	0.34J-11.6	44/44	0.466-63.9	9	Yes
Barium	550	5/19	4.9-26.9	44/44	4.2J-80.2	0	No
Beryllium	16	2/19	0.3-0.34	31/44	0.23J-0.93J	0	No
Cadmium	3.9	5/19	1.5J-38.4J	2/44	1.3K-1.5	3	Yes
Calcium+	--	8/19	341-4,620	44/44	39.4J-7,820	--	No
Chromium	23	15/19	2.5-32.3	44/44	2.6-18.3	2	Yes
Cobalt	470	4/19	0.78-4.1	42/44	1J-6.7J	0	No
Copper	310	10/19	1.6-61.9	35/44	1.2J-24.4	0	No
Cyanide	160	3/19	0.19-0.25	0/44	ND	0	No
Iron	2,300	19/19	1.400-31,100	44/44	1,440-19,900	13	Yes
Lead	400[10]	19/19	4.6-43	44/44	6.4-43.1	0	No
Magnesium+	--	5/19	163-970	44/44	61.5J-1,610	--	No
Manganese	160	19/19	3.7J-1,310J	44/44	7.6L-491	2	Yes

TABLE 2-2 (continued)

SURFACE SOIL DATA AND COPC SELECTION SUMMARY
SITE 21
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Contaminant[1]	Region III Criteria[2]	Contaminant Frequency/Range[3]		Background [4]		Comparison to Criteria	COPC Selection
	Residential COC Value (mg/kg)	No. of Positive Detects/ No. of Samples	Range of Positive Detections (mg/kg)	No. of Positive Detects/ No. of Samples	Range of Positive Detections (mg/kg)	Positive Detects Above Residential COC Value	Selected as a COPC?
Mercury	2.3[11]	7/19	0.06J-4.4J	0/44	ND	2	Yes
Nickel	160	5/19	1.9-10.5	36/44	3.8J-11.9	0	No
Potassium+	--	5/19	215-1,290	15/44	398J-1,640J	--	No
Selenium	39	3/19	0.93K-1.2K	23/44	0.26L-0.55L	0	No
Silver	39	1/19	1.2	2/44	1J-2.1J	0	No
Sodium+	--	1/19	746	44/44	13.9J-115J	--	No
Thallium	0.55	1/19	1.8	0/44	ND	1	Yes
Vanadium	55	6/19	12.4-49.4	44/44	6.1J-34.7J	0	No
Zinc	2,300	18/19	7.8-6,780	44/44	3.2KJ-48.4	1	Yes

Notes:

(1) Organic concentrations converted to mg/kg; inorganic concentrations reported in mg/kg.
(2) COC = USEPA Region III COC screening value (USEPA, 1993b, 1999b).
(3) J = Analyte was positively identified, value is estimated.
K = Estimated value, biased high.
L = Estimated value, biased low.
(4) Baker, 1995.
(5) Value for acenaphthene used as a surrogate for acenaphthylene.
(6) Re-included as COPC because of possible additive effect of carcinogenic polynuclear aromatic hydrocarbons.
(7) Value for pyrene used as a surrogate for benzo(g,h,i) perylene.
(8) Value for endrin used as a surrogate for endrin ketone.
(9) Value for chlordane used as a surrogate.
(10) Action level for residential soils (USEPA, 1994).
(11) Value for mercuric chloride used as surrogate.

-- = No criteria published
+ = Essential Nutrients
NA = Not Applicable
ND = Not Detected

TABLE 2-3

SUBSURFACE SOIL DATA AND COPC SELECTION SUMMARY
SITE 21
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Contaminant[1]	Region III Criteria[2]	Contaminant Frequency/Range[3]		Background [4]		Comparison to Criteria	COPC Selection
	Residential COC Value (mg/kg)	No. of Positive Detects/ No. of Samples	Range of Positive Detections (mg/kg)	No. of Positive Detects/ No. of Samples	Range of Positive Detections (mg/kg)	Positive Detects Above Residential COC Value	Selected as a COPC?
Volatiles							
Acetone	780	1/8	0.11J	NA	NA	0	No
Methylene chloride	85	3/8	0.018J-0.038	NA	NA	0	No
Toluene	1,600	2/8	0.002J-0.004J	NA	NA	0	No
Semivolatiles							
Phenol	4,700	1/8	0.026J	NA	NA	0	No
Di-n-butylphthalate	780	3/8	0.044J-0.17J	NA	NA	0	No
Fluoranthene	310	1/8	0.048J	NA	NA	0	No
Pyrene	230	1/8	0.05J	NA	NA	0	No
Chrysene	88	3/8	0.042J-0.051J	NA	NA	0	No
Bis(2-ethylhexyl)phthalate	46	4/8	0.043J-0.071J	NA	NA	0	No
Benzo(b)fluoranthene	0.88	3/8	0.052J-0.085J	NA	NA	0	No
Benzo(a)pyrene	0.088	3/8	0.049J-0.085J	NA	NA	0	No
Benzo(g,h,i)perylene	230[5]	1/8	0.037J	NA	NA	0	No
Pesticides							
4,4'-DDE	1.9	2/8	0.002J-0.0067	NA	NA	0	No
4,4'-DDD	2.7	2/8	0.0028J-0.025J	NA	NA	0	No
4,4'-DDT	1.9	2/8	0.0081-0.038J	NA	NA	0	No
Alpha-chlordane	1.8[6]	1/8	0.0024J	NA	NA	0	No
Gamma-chlordane	1.8[6]	1/8	0.002J	NA	NA	0	No
PCBs							
Aroclor-1260	0.32	1/8	0.032J	NA	NA	0	No
Inorganics							
Aluminum	7,800	8/8	1,040-5,230	16/16	2,710-28,200	0	No
Arsenic	0.43	7/8	0.73-10.1J	16/16	0.23J-42.7	7	Yes
Barium	550	2/8	14.2-20	16/16	10.6J-66.9	0	No
Beryllium	16	1/8	0.29	13/16	0.3J-9.8	0	No
Calcium+	--	2/8	594-706	16/16	28.9J-233,000	--	No
Chromium	23	6/8	2.4-28.2	16/16	5.2L-33.5	1	Yes

TABLE 2-3 (continued)

SUBSURFACE SOIL DATA AND COPC SELECTION SUMMARY
SITE 21
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Contaminant[1]	Region III Criteria[2]	Contaminant Frequency/Range[3]		Background [4]		Comparison to Criteria	COPC Selection
	Residential COC Value (mg/kg)	No. of Positive Detects/ No. of Samples	Range of Positive Detections (mg/kg)	No. of Positive Detects/ No. of Samples	Range of Positive Detections (mg/kg)	Positive Detects Above Residential COC Value	Selected as a COPC?
Copper	310	5/8	6.8-31.8	16/16	2J-15	0	No
Iron	2,300	8/8	1,890-20,300	16/16	3,810J-51,100J	6	Yes
Lead	400[7]	8/8	5.2J-68.9J	16/16	3.6L-25.5L	0	No
Magnesium+	--	2/8	108-130	16/16	136J-2,870	--	No
Manganese	160	8/8	35.7-383	16/16	3.5J-2,940	1	Yes
Mercury	2.3[8]	3/8	0.09-0.69J	0/16	ND	0	No
Vanadium	55	2/8	14.9-27.3	15/16	7.8J-70.3L	0	No
Zinc	2,300	7/8	35.6-719J	16/16	3.6J-330	0	No

Notes:

(1) Organic concentrations converted to mg/kg; inorganic concentrations reported in mg/kg.
(2) COC = USEPA Region III COC screening value (USEPA, 1993b, 1999b).
(3) J = Analyte was positively identified, value is estimated.
(4) Baker, 1995; L = Estimated value, biased low.
(5) Pyrene used as a surrogate.
(6) Chlordane used as a surrogate.
(7) Action level for residential soils (USEPA, 1994).
(8) Mercuric chloride used as a surrogate.

-- = No criteria published
+ = Essential Nutrients
NA = Not Applicable
ND = Not Detected

TABLE 2-4

TOTAL INCREMENTAL LIFETIME CANCER RISK AND HAZARD INDEX VALUES FOR POTENTIAL CURRENT RECEPTORS[(1)]
SITE 21
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Receptors [(2)]	Site 21	
	Total ILCR	Total HI
Adult On-Base Trespasser	3.3×10^{-6}	1.5
Adolescent On-Base Trespasser	3.2×10^{-6}	2.0
Commercial/Industrial Worker	5.3×10^{-6}	0.7

Notes:

(1) Shaded values represent exceedences of USEPA acceptable risk criteria (i.e., ILCR > 1×10^{-4} and HI $\geq$ 1.0).

(2) Adult and adolescent trespassers could potentially be exposed to COPCs in surface soil by accidental ingestion and dermal contact. Commercial/utility workers could potentially be exposed to COPCs by accidental ingestion, dermal contact, and inhalation of fugitive dusts emanating from surface soil.

TABLE 2-5

TOTAL INCREMENTAL LIFETIME CANCER RISK AND HAZARD INDEX VALUES FOR POTENTIAL FUTURE RECEPTORS[1]
SITE 21
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Receptors [2]	Site 21	
	Total ILCR	Total HI
Adult On-Base Residents	5.6×10^{-6}	1.0
Adolescent Resident Children	5.3×10^{-6}	1.5
Younger Resident Children	1.4×10^{-5}	2.8
Adult Construction Workers [3]	6.6×10^{-7}	0.7

Notes:

(1) Shaded values represent exceedances of USEPA acceptable risk criteria (i.e., ILCR $> 1 \times 10^{-4}$ and HI $\geq$ 1.0).
(2) Future residents could potentially be exposed to COPCs by accidental ingestion and dermal contact with surface soil.
(3) Construction workers could potentially be exposed to COPCs by accidental ingestion, dermal contact, and inhalation of dust emanating from subsurface soil.

TABLE 2-6

RISK CHARACTERIZATION SUMMARY FOR POTENTIAL FUTURE RECEPTORS–NONCARCINOGENS
SITE 21
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Scenario Timeframe: **6 years**
Receptor Population: **young children**
Receptor Age: **0 to 6 years**

Medium	Chemical of Concern	Exposure Point Concentrations (mg/kg)	Primary Target Organ	Noncarcinogenic Hazard Quotient		
				Ingestion	Dermal	Exposure Routes Total
Soil	Cadmium	7.74	Kidney	0.10	0.20	0.30
	Chromium	11.89	Stomach and Nasal Mucosa	0.05	0.50	0.55
	Iron	10,008	Heart	0.43	0.20	0.63
	Manganese	2.50	Central Nervous System and Lung	0.16	0.32	0.48
	Mercury	1.1	Kidney and Central Nervous System	0.14	0.10	0.24
					Central Nervous System Hazard Index =	0.7
					Kidney Hazard Index =	0.5
					Total Hazard Index =	2.2[1]

Note:
[1] Accounts for approximately 80% of the total HI value (2.8).

TABLE 2-7

ASSESSMENT ENDPOINTS, RISK HYPOTHESES, MEASUREMENT ENDPOINTS, AND RECEPTOR SPECIES
SITE 21
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint	Receptor
TERRESTRIAL ASSESSMENTS			
Protection of insectivorous mammals to ensure that ingestion of contaminants in soil and prey does not have a negative impact on growth, survival, and reproduction.	Are levels of site contaminants in surface soil sufficient to cause adverse effects on the growth, survival, and reproductive success of insectivorous mammals using the site?	Comparison of dietary HQs to a reference of 1.0. Dietary HQs are calculated for individual chemicals by dividing estimated intake by a toxicity value associated with a NOAEL.(1)	Short-Tailed Shrew
Protection of herbivorous mammals to ensure that ingestion of contaminants in soil and vegetation does not have a negative impact on growth, survival, and reproduction.	Are levels of site contaminants in surface soil sufficient to cause adverse effects on the growth, survival, and reproductive success of herbivorous mammals using the site?	Comparison of dietary HQs to a reference of 1.0. Dietary HQs are calculated for individual chemicals by dividing estimated intake by a toxicity value associated with a NOAEL.	Meadow Vole
Protection of omnivorous mammals to ensure that ingestion of contaminants in soil, prey, and forage does not have negative impacts on growth, survival, and reproduction.	Are levels of site contaminants in surface soil sufficient to cause adverse effects on the growth, survival, and reproductive success of omnivorous mammals using the site?	Comparison of dietary HQs to a reference of 1.0. Dietary HQs are calculated for individual chemicals by dividing estimated intake by a toxicity value associated with a NOAEL.	Deer Mouse
Protection of carnivorous mammals to ensure that ingestion of contaminants in soil and prey does not have a negative impact on growth, survival, and reproduction.	Are levels of site contaminants in surface soil sufficient to cause adverse effects on the growth, survival, and reproductive success of carnivorous mammals using the site?	Comparison of dietary HQs to a reference of 1.0. Dietary HQs are calculated for individual chemicals by dividing estimated intake by a toxicity value associated with a NOAEL.	Red Fox
Protection of insectivorous birds to ensure that ingestion of contaminants in soil or food items does not have negative impacts on growth, survival, and reproduction.	Are levels of site contaminants in surface soil sufficient to cause adverse effects on the growth, survival, and reproductive success of insectivorous birds using the site?	Comparison of dietary HQs to a reference HQ of 1.0. Dietary HQs are calculated for individual chemicals by dividing an estimated intake by a toxicity value associated with a NOAEL.	American Woodcock and Marsh Wren
Protection of herbivorous birds to ensure that ingestion of contaminants in soil or vegetation does not have negative impacts on growth, survival, and reproduction.	Are levels of site contaminants in surface soil sufficient to cause adverse effects on the growth, survival, and reproductive success of birds using the site?	Comparison of dietary HQs to a reference HQ of 1.0. Dietary HQs are calculated for individual chemicals by dividing an estimated level of exposure by a toxicity value that is associated with a NOAEL.	Bobwhite Quail

TABLE 2-7 (Continued)

ASSESSMENT ENDPOINTS, RISK HYPOTHESES, MEASUREMENT ENDPOINTS, AND RECEPTOR SPECIES
SITE 21
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint	Receptor
TERRESTRIAL ASSESSMENTS			
Protection of omnivorous birds to ensure that ingestion of contaminants in soil or food items does not have negative impacts on growth, survival, and reproduction.	Are levels of site contaminants in surface soil sufficient to cause adverse effects on the growth, survival, and reproductive success of birds using the site?	Comparison of dietary HQs to a reference HQ of 1.0. Dietary HQs are calculated for individual chemicals by dividing an estimated level of exposure by a toxicity value that is associated with a NOAEL.	American Robin
Protection of carnivorous birds to ensure that ingestion of contaminants in soil or food items does not have negative impacts on growth, survival, and reproduction.	Are levels of site contaminants in surface soil sufficient to cause adverse effects on the growth, survival, and reproductive success of birds using the site?	Comparison of dietary HQs to a reference HQ of 1.0. Dietary HQs are calculated for individual chemicals by dividing an estimated intake by a toxicity value associated with a NOAEL.	Red-Tailed Hawk
Protection of mammals feeding on prey organisms from toxic effects of site-related chemicals present in surface water or sediment.	Are levels of site contaminants in soil sufficient to cause adverse effects on growth, survival, and reproductive success of mammals that eat prey species and use the site?	Comparison of dietary HQs to a reference HQ of 1.0. Dietary HQs are calculated for individual chemicals by dividing an estimated intake by a toxicity value associated with a NOAEL.	Red Fox

Note:
(1) NOAEL – No Observed Adverse Effect Level

TABLE 2-8
FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO SURFACE SOIL SCREENING LEVELS
SITE 21
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Analyte	Contaminant Frequency/Range				Surface Soil Screening Levels [2]	Max HQ [3]	WPNSTA Background		ECOC?
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Arithmetic Mean (Half Non-Detects)	Value Used in Screen [1]			No. of Positive Detects/No. of Samples	Range of Background Concentrations	
VOLATILES (µg/kg)									
METHYLENE CHLORIDE	1/14	60 - 60	11.00	60	1001 (4)(5)(6)	0.06	2/13	7J-9J	No
ACETONE	1/14	7J - 7J	6.93	7	NE	NA	2/13	8J-13	No
TOLUENE	3/14	1J - 3J	6.32	3	13005 (4)(5)(6)	0.00	0/13	ND	No
STYRENE	1/14	lJ - 1J	6.75	1	10010 (4)(5)(6)	0.00	0/13	ND	No
SEMIVOLATILES (µg/kg)									
ACENAPHTHYLENE	1/19	110J - 110J	288.68	110	100	1.10	0/13	ND	Yes
DI-N-BUTYLPHTHALATE	3/19	42J - 360J	1193.79	360	200000 (7)(5)	0.00	0/13	ND	No
FLUORANTHENE	1/19	270J - 270J	297.11	270	4100 (4)(5)(8)	0.07	4/13	120J - 430	No
PYRENE	2/19	49J - 260J	288.11	260	100	2.60	3/13	160J - 320J	Yes
BUTYLBENZYLPHTHALATE	7/19	43J - 1400	392.53	1400	NE	NA	0/13	ND	Yes
BENZO(A)ANTHRACENE	1/19	200J - 200J	293.42	200	4100 (4)(5)(8)	0.05	2/13	120J - 240J	No
CHRYSENE	1/19	260J - 260J	296.58	260	4100 (4)(5)(8)	0.06	3/13	150J - 270J	No
BIS(2-ETHYLHEXYL)PHTHALATE	10/19	74J - 260J	194.79	260	NE	NA	0/13	ND	No
BENZO(B)FLUORANTHENE	1/19	910 - 910	330.79	910	100	9.10	3/13	230J - 500	Yes
BENZO(K)FLUORANTHENE	1/19	220J - 220J	294.47	220	4100 (4)(5)(8)	0.05	2/13	120J - 130J	No
BENZO(A)PYRENE	1/19	140J - 140J	290.26	140	4100 (4)(5)(8)	0.03	2/13	140J - 180J	No
INDENO(1,2,3-CD)PYRENE	1/19	130J - 130J	289.74	130	4100 (4)(5)(8)	0.03	1/13	160J - 160J	No
BENZO(G,H,I)PERYLENE	1/19	110J - 110J	288.68	110	4100 (4)(5)(8)	0.03	0/13	ND	No
PESTICIDES/PCBS (µg/kg)									
GAMMA-BHC (LINDANE)	2/19	13 - 22	2.89	22	100 <	0.22	0/13	ND	No
HEPTACHLOR	2/19	13 - 22	2.89	22	100 -9	0.22	0/13	ND	No
ALDRIN	2/19	11 - 20	2.68	20	100 <	0.20	0/13	ND	No
HEPTACHLOR EPOXIDE	1/19	0.34J - 0.34J	1.15	0.34	100 <	0.00	0/13	ND	No
DIELDRIN	5/19	0.085J - 46	5.68	46	100 <	0.46	0/13	ND	No
4,4'-DDE	9/19	0.62J - 39	3.82	39	100 <	0.39	0/13	ND	No
ENDRIN	2/19	31 - 51	6.37	51	100 <	0.51	0/13	ND	No
4,4'-DDD	3/19	3.2J - 190J	13.64	190	100 <	1.90	0/13	ND	Yes
4,4'-DDT	2/19	4.3 - 33	4.91	33	100 <	0.33	0/13	ND	No
METHOXYCHLOR	3/19	1.3J - 2.8J	9.57	2.8	100 <	0.03	0/13	ND	No
ENDRIN KETONE	1/19	0.95J - 0.95J	2.28	0.95	100 < (10)	0.01	0/13	ND	No
ALPHA-CHLORDANE	3/19	2.6 - 15	2.07	15	100 < (11)	0.15	0/13	ND	No
GAMMA-CHLORDANE	3/19	3 - 13	1.97	13	100 < (11)	0.13	0/13	ND	No

TABLE 2-8 (Continued)
FREQUENCY AND RANGE OF SURFACE SOIL DATA COMPARED TO SURFACE SOIL SCREENING LEVELS
SITE 21
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Analyte	Contaminant Frequency/Range				Surface Soil Screening Levels(2)	Max HQ (3)	WPNSTA Background		ECOC?
	No. of Positive Detects/No. of Samples	Range of Positive Detections	Arithmetic Mean (Half Non-Detects)	Value Used in Screen(1)			No. of Positive Detects/No. of Samples	Range of Background Concentrations	
TOTAL INORGANICS (mg/kg)									
ALUMINUM	19/19	938 - 43300	6424.11	43300	50 (5)(7)	866.00	57/57	1960 - 24100	Yes
ARSENIC	10/19	0.34J - 11.6	2.49	11.6	60 (5)(12)	0.19	57/57	0.46L - 63.9	No
BARIUM	5/19	4.9 - 26.9	12.67	26.9	500 (5)(12)	0.05	57/57	4.2J - 80.2	No
BERYLLIUM	2/19	0.3 - 0.34	0.15	0.34	10 (5)(12)	0.03	38/57	0.23J - 0.93J	No
CADMIUM	5/19	1.5J - 38.4J	3.88	38.4	4 (5)(12)	9.60	3/57	1.2J - 1.5	Yes
CALCIUM	8/19	341 - 4620	1005.24	4620	NE	NA	57/57	39.4J-7820	No
CHROMIUM	15/19	2.5 - 32.3	8.28	32.3	0.4 (5)(12)(13)	80.75	57/57	2.6 - 33.5	Yes
COBALT	4/19	0.78 - 4.1	1.08	4.1	100 -14	0.04	54/57	0.88J - 6.7J	No
COPPER	10/19	1.6 - 61.9	10.70	61.9	50 (5)(12)	1.24	48/57	1.2J - 24.4	Yes
IRON	19/19	1400 - 31100	6779.47	31100	200 (5)(12)	155.50	57/57	1440 - 46400	Yes
LEAD	19/19	4.6 - 43	16.41	43	50 (4)(5)	0.86	57/57	2.1 - 43.1	No
MAGNESIUM	5/19	163 - 970	224.01	970	4400	0.22	57/57	61.5J-2700	No
MANGANESE	19/19	3.7J - 1310J	134.51	1310	500 (4)(5)	2.62	57/57	7.6L - 491	Yes
MERCURY	7/19	0.06J - 4.4J	0.60	4.4	0.1 (5)(12)	44.00	1/57	0.05J - 0.05J	Yes
NICKEL	5/19	1.9 - 10.5	2.83	10.5	30 (4)(5)	0.35	43/57	3.8J - 12.5	No
POTASSIUM	5/19	215 - 1290	231.71	1290	NE	NA	23/57	387J-1640J	No
SELENIUM	3/19	0.93K - 1.2K	0.35	1.2	1.8	0.67	30/57	0.21L - 0.61L	No
SILVER	1/19	1.2 - 1.2	0.28	1.2	2 (4)(5)	0.60	5/57	1J - 2.1J	No
SODIUM	1/19	746 - 746	54.66	746	NE	NA	57/57	12J-115J	No
THALLIUM	1/19	1.8 - 1.8	0.37	1.8	1 (4)(5)	1.80	0/57	ND	Yes
VANADIUM	6/19	12.4 - 49.4	10.53	49.4	2 (4)(5)	24.70	57/57	5.2J - 64.7	Yes
ZINC	18/19	7.8 - 6780	522.93	6780	50 (4)(5)	135.60	57/57	3.2KJ - 48.4	Yes

Notes:
ECOC Ecological Contaminant of Concern
HQ Hazard Quotient
J Value Estimated
K Value Biased High
L Value Biased Low
U Not Detected
NE Not Established
NA Not Applicable
μg/kg micrograms per kilogram
mg/kg milligrams per kilogram
h Value dependent on water hardness
< Screening value indicates upper limit
Shaded area represents ECOCs and highlights HQ > 1.0.

(1) Maximum detected value
(2) USEPA Region III BTAG screening values unless otherwise noted (USEPA, 1995)
(3) HQ = Value used in Screen/Screening Level
(4) MHSPE, 1994
(5) Alternate Screening Value (CH2M HILL, 2000)
(6) Value dependent on Total Organic Carbon (TOC)
(7) Efroymson, Will, Suter, and Wooten, 1997 (ORNL Terrestrial Plants)
(8) Screening value for total PAHs
(9) Screening level for Heptachlor Epoxide
(10) Screening level for Endrin
(11) Screening value for Chlordane
(12) Efroymson, Will, and Suter, 1997 (ORNL Soil Invertebrates)
(13) Screening level for Chromium VI
(14) Value dependent on pH

TABLE 2-9

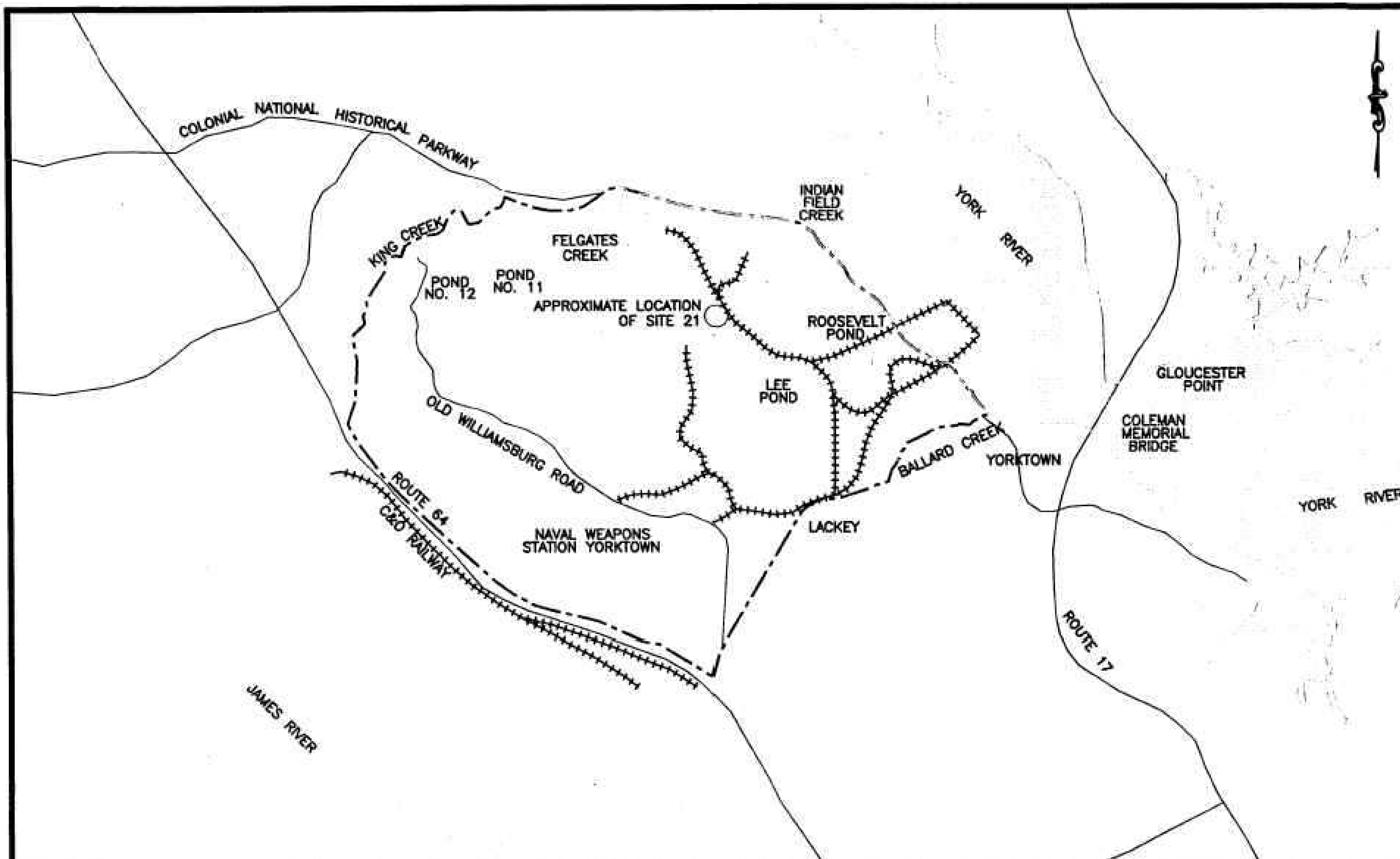
SELECTION OF REMEDIATION LEVELS
SITE 21–SOIL
NAVAL WEAPONS STATION, YORKTOWN
YORKTOWN, VIRGINIA

Contaminant	Station-Wide Background (mg/kg)	Human Health PRG (mg/kg)	Ecological Uptake Goal (mg/kg)	Flora Toxicity Benchmark (mg/kg)	Fauna Toxicity Benchmark (mg/kg)	Final Remediation Goal (mg/kg)
cPAHs	NA	--	--	NE	NE	**1**(1)
Aluminum	24,100	--	1.4	50	600	**24,100**
Cadmium	1.5	--	0.9	4	20	**4**
Manganese	491	--	117	50	10	**491**
Mercury	0.05	--	0.3	0.03	0.05	**0.24**(2)
Thallium	ND	--	0.01	1.0	1.0	**0.1**(2)
Zinc	48.4	--	410(3)	50	100	**410**

Notes:

(1) Derived from Site 4
(2) Yorktown Partnering Team risk management decision
(3) Effects range–medium sediment value applied to soil
-- Not a contaminant of concern for this receptor
ND Not detected
PRG Preliminary Remediation Goal

FIGURES



NOT TO SCALE

LEGEND

WATER BOUNDARY OR DRAINAGE

ROADWAY

RAILROAD

INSTALLATION BOUNDARY

2275501R

FIGURE 2-1
LOCATION OF NAVAL WEAPONS STATION YORKTOWN

NAVAL WEAPONS STATION YORKTOWN — YORKTOWN, VIRGINIA

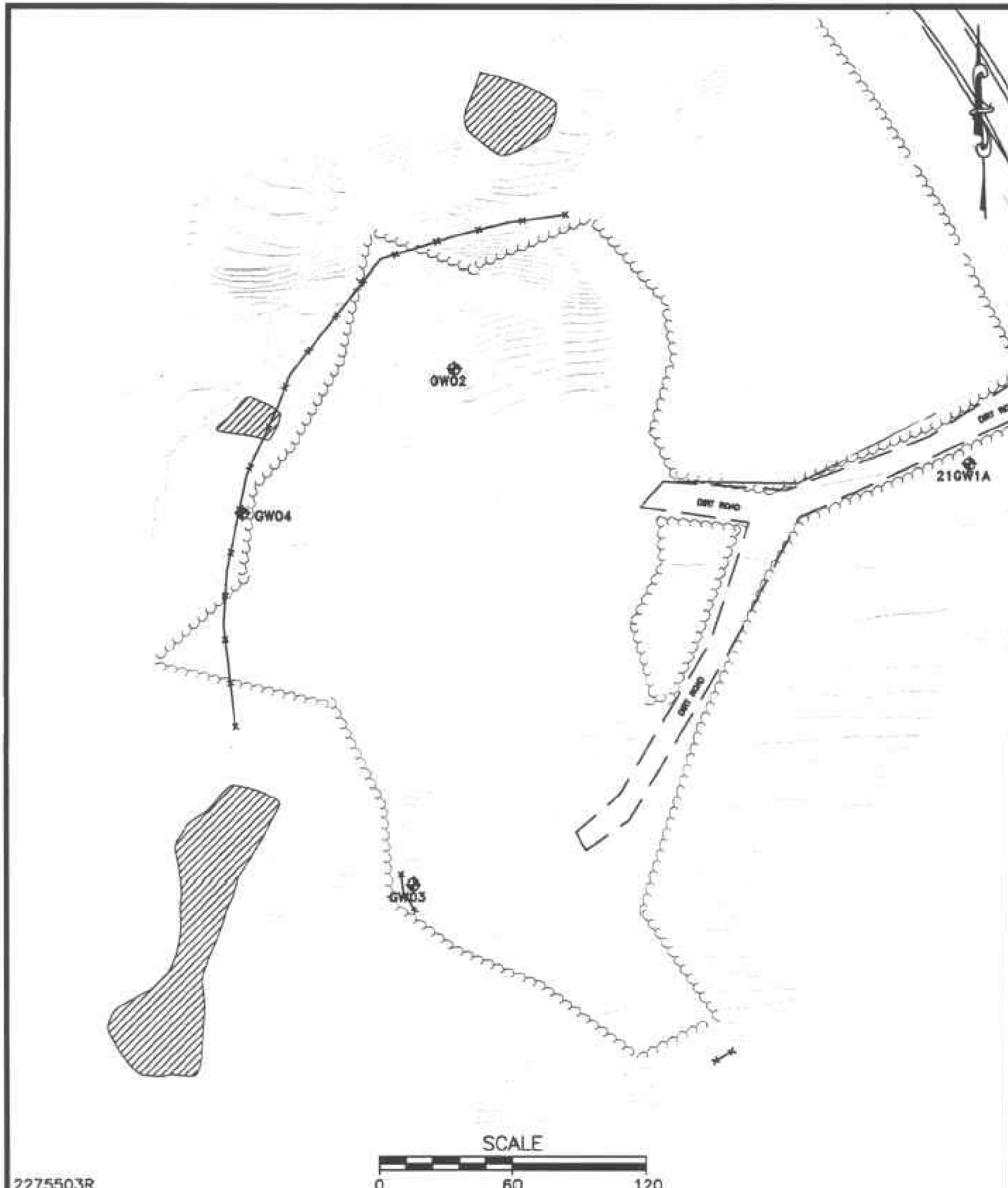
LEGEND

- REMEDIAL INVESTIGATION SITE
- MARSH
- RIPRAP
- DEBRIS AREA
- TREE LINE
- INTERMITTENT DRAINAGE

SOURCE: MILLER-STEPHENSON & ASSOCIATES, MAY 1996.

FIGURE 2-2
VICINITY MAP
SITE 21

NAVAL WEAPONS STATION YORKTOWN YORKTOWN, VIRGINIA



LEGEND

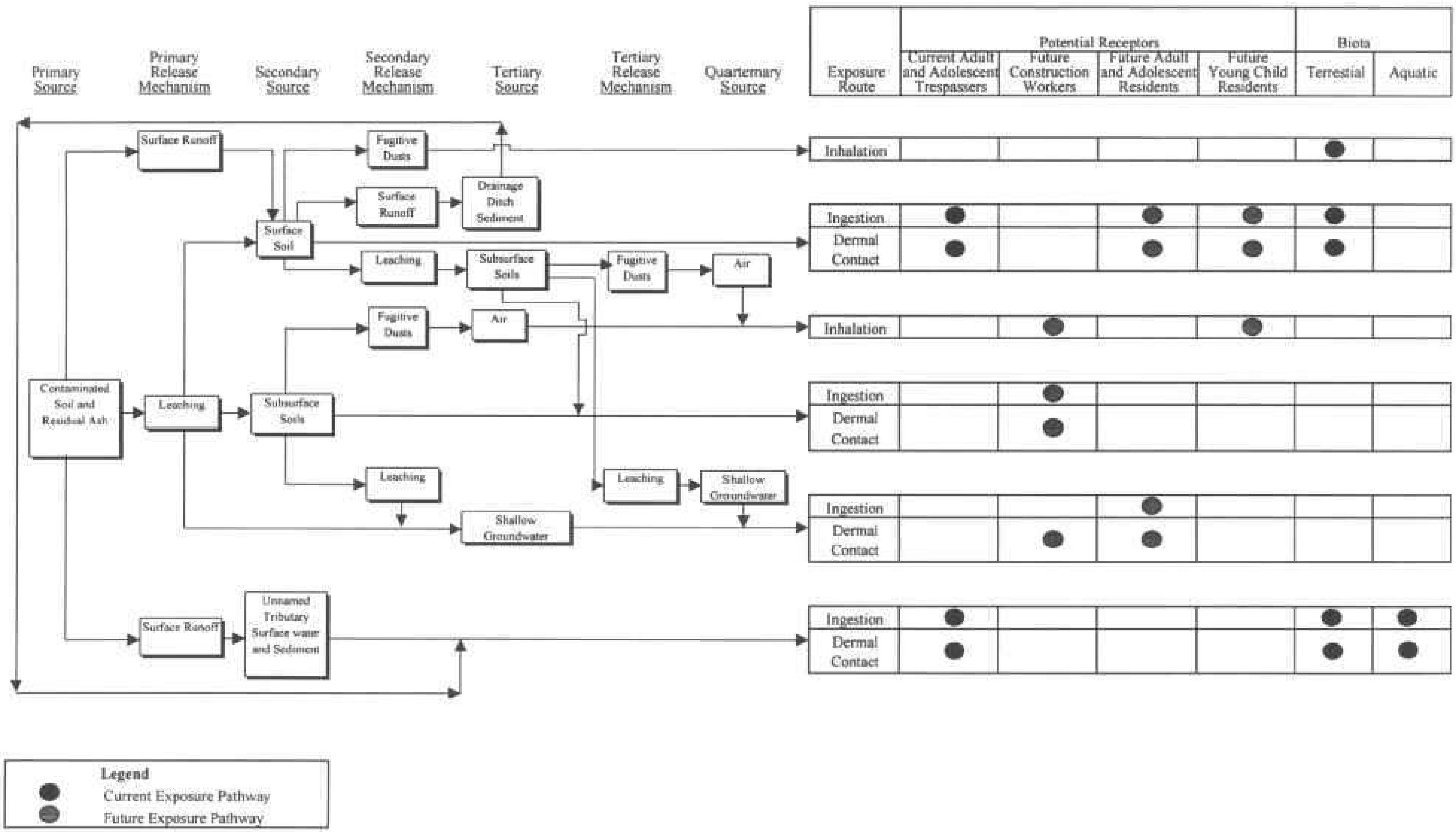
EDGE OF PAVEMENT
FENCE
EDGE OF WOODS
DRAINAGE DITCH
CONTOUR LINE
MONITORING WELL LOCATION
REMOVAL AREA

BASE MAP PROVIDED BY SHAW ENVIRONMENTAL AND INFRASTRUCTURE, INC.

FIGURE 2-3
2002 NON-TIME-CRITICAL
REMOVAL AREAS
SITE 21

NAVAL WEAPONS STATION YORKTOWN YORKTOWN, VIRGINIA

FIGURE 2-4
CONCEPTUAL SITE MODEL
SITE 21
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA



APPENDIX A

TRANSCRIPT OF FEBRUARY 21, 2001 PUBLIC MEETING

PROPOSED REMEDIAL ACTION PLAN BRIEFING

FOR SITES 4, 21 & 22

OPERABLE UNITS (OUs) XVI, XVII and

XVIII

TRANSCRIPT OF PROCEEDINGS

February 21, 2001

Lackey, Virginia

TAYLOE ASSOCIATES, INC.

Registered Professional Reporters

Telephone: (757) 461-1984

Norfolk, Virginia

MS. PHILLIPS: We want to welcome you to our quarterly meeting, and glad everybody could make it out tonight, maybe before the snow comes. If Jeff is short-winded tonight, then maybe that means we’re going to get snow. But if he’s his usual, we won’t get any snow.

Before we get started, I wanted to call your attention -- you might think I wasted my time in sending Petty Officer Varner out to interview these guys, but Petty Officer Varner spent about a day with these guys while they were, quote, working, and she has written this nice article that we got in the booster. We also got it in the Flagship. You have copies of it, I think, in front of you. It's called, Navy Creates Environmentally Clean Dream Team in Yorktown. She was very creative in her title, so I hope you'll enjoy reading that and see the publicity, that we are trying to get these people out there for everyone.

And we’d like to welcome -- I think, Captain Skudin, this is your second meeting?

CAPTAIN SKUDIN: Yes, ma’am.

MS. PHILLIPS: Nice having you here tonight. Would you like to make any comments?

CAPTAIN SKUDIN: Let it snow, let it

snow, let it snow.

MS. PHILLIPS: And I'll be waiting here to get the closings to the radio stations.

Jay is our cochair. Do you have comments?

MR. DEWING: No, I don't have any comments. Maybe later.

MS. PHILLIPS: I’m sure you might have some questions a little bit later. Well, tonight we’re supposed to begin the meeting with our public meeting on the proposed remedial action plan for sites four, 21, and 22, and so I'll turn it to Rich.

MR. HOFF: Thanks, Kay. Good evening, everyone. I'm glad to see everybody could make it. Tonight we’ll start with a proposed remedial action plan briefing.

The purpose of the plan briefing is to make the public aware that we are in the process of beginning to take some remedial action at these three particular sites. And the reason that we have this meeting is to engage the public and to solicit comments from the public based upon what we discuss this evening regarding our remedial action plan for the sites.

We’ve talked about these sites a good bit over the past several RAB meetings. This is nothing new to the members here tonight. And because we don't have anybody from the public, outside of our normal RAB that I see, I think what I'll do is I'll try to be as brief as possible.

Sites four, 21 and 22, these are the sites located within the central to north central portion of the stadium -- not stadium -- you can tell I come from Pittsburgh -- of the station, and they are bounded to the west by Felgates Creek and to the northeast by Main Road.

We have placed maps around the table of the Naval Weapons Station, Cheatham Annex, to give you an idea of the approximate location of the size, and they are located, as I said, in the central portion of the Naval Weapons Station Yorktown along the main branch of Felgates.

These sites reside within the restricted area of the station. Human activity is very limited at these sites. And really our main concern with these sites are potential risk to ecological receptors. As you see and as I go through it, there are very few unacceptable risks identified to human health, and that's because there is such little contact or little opportunity for contact to contaminants of the soil.

Surprisingly, the contamination of these sites is somewhat low, but that's to be expected because back in 1994-1995 time frame, we did a removal action, a rather large one. I believe it was IT that conducted the removal action. And thousands of tons of debris, contaminated ash, and impacted soils were removed from all of these sites and disposed of off site.

And it was fortunate that we did this because I think it makes the investigation and what we have to do much easier when we don’t have to work around large debris piles. And I think it also mitigates probably the greatest extent of the risk as we’ll see.

This is a better idea of the location. This is not a stadium, this is Naval Weapons Station Yorktown, and, again this is the main branch of Felgates Creek, the York River. And we’re running off the Main Road, so we’re pretty much well away from anything in terms of human activity at the station.

A little background on Weapon Stations Yorktown. We became an NPL site in 1992, and we finalized our federal facilities agreement in August of 1994. Originally we had identified 16 sites in the federal facilities agreement, including a list of site screening areas and 21 of RECWA (phonetic) or CERCLA areas of concern. And these were inventoried very early on in the process.

Currently, we have 11 active sites and one site screening area remaining. These are sites under investigation or in various processes of investigation and will soon be in the remedial action stage.

If you follow what we've been doing over the years, we break our sites down into operable units when it comes to remediation, and this is really an accounting practice to keep track of the various sites of how we remediate medially those sites. And by "media," I mean surface soils, sediment, et cetera.

What it allows us to do is take a site and subdivide it, if we need to, to address what we believe are the worst or the most egregious contamination problems.

For instance, we might break the soil away from the groundwater because we feel that we need to take an immediate action on the soil. And by doing that, we greatly simplify the record of decision process and also the public involvement process. I think it's much easier to come in here and talk about a specific media and the risks that it poses as opposed to multiple media across the site. It becomes very confusing. So this is an accounting practice.

Currently, we have 14 records of decision that have been signed, and they really -- I'm sorry -- numerous RODs signed, but 14 ROD sites and two SSAs have been signed off on, and we are either in the process of construction or we have completed construction.

Site four, 21, and 22 are going to be labeled operable units. And 16, 17, and 18 -- and the way they are grouped here is really a function of how we intend to present the information to the EPA's office of counsel. What we have done is grouped sites four and 22 together. The reason for that is that there are some RECWA concerns regarding those sites.

If you remember site 22 is our burn pad. And site four is an area where ash from the burn pad was stored, so we've combined those sites into a single record of decision to address the RECWA issues that can come about as a result of past activities at site 22.

Site 21, as you'll see, was addressed later in our program. It was identified even after the FFA was completed and was added later. And the reason being, we had discovered batteries and some debris that was disposed of in the wood line and it became part of the 1994-‘95 removal action. There was still some residual contamination remaining in the soil, so we parsed it out and made it site 21.

This is structured pretty much the way we presented it to the EPA’s office of regional counsel, so we go right to the heart of the issue. The preferred alternative for site four is excavation of off-site disposal of PAH and inorganic contaminated soils. The type of soil, the volume of soil, the depth of contamination is very conducive to a removal and an off-site disposal.

We’ve evaluated other alternatives, which I’ll talk about a little bit later, but we feel that this combines the best of all worlds, cost, protection of human health, and the environment, permanency of the remedy. And we then intend to confirm that the samples in the area of those removals will be -- there will be confirmatory sampling to determine the contamination has been removed, so we won’t leave anything that would cause risk of subsequent exposures. Of course, we’ll backfill and bring it to grade and reestablish native plant species, as we’ve discussed, with our regulatory counterparts.

The preferred alternative for site 21 is very similar. We have some inorganic contaminants in the soil. These are really residual from the removal action of '94-'95. There's no human health problem or threat here, but we have inorganic contamination that would affect receptors in our ecological risk models.

And we do this by looking at individuals and not at populations. We get into ecological risk assessments. There's always the discussion of, does it affect an individual? Does it affect a population? So we're talking a very conservative look at this, and we're saying, we won't worry about population effects. If we have ecological uptake models that indicate risk, we're going to get that stuff out of there. There's only a couple of hundred yards of soil that will have to be removed from site 21 to really write it off, and it will prevent us from having to do any sort of long-term monitoring or institutional controls after the remedial action.

Site 22 is a little different. This is where we have the biocell. And the biocell is now inactive, so we're going to demolish and dispose of the biocell. We will sample accordingly to determine that there's no RECWA hazardous waste left on-site.

Our intent here is to clean close this area so that you don’t, again, have to do any long-term monitoring or put any type of property use restrictions in place. Again, we’ll do confirmatory sampling to ensure the removal has been effective, and, again, we’ll backfill and reestablish native plants.

And I want to stress that groundwater, surface water, and sediment will be addressed as a future operable unit for all of these sites. So this is really a soil remedy.

Just an overview of the proximity of the sites. Again, you have West Road, the biocell -- or the former biocell where we did the simplot work. Site 21 is a small area just to the east of site 22.

And you’ve seen this picture many times. This is a picture of site 22, the burn pad where the explosives -- contaminated materials and some explosive material was burned. This is where the ash pile was. It was located in this area of site four. And there was miscellaneous debris disposed throughout the site four area that was taken out during the removal action.

That’s a more current look at site 22. This is when the gantry system was in place and the biocell was operational.

This is site 21, and it pretty much looks like this. There's certainly more overgrowth today. This was a very complete removal that was conducted here. Off the top of my head, I believe about 5,000 tons of batteries and miscellaneous debris was removed from the backside and disposed of accordingly. It was a very complete removal action. And the only reason we came back to it was, as I said, there was some residual inorganic contamination and soil.

Brief description. Site four is about a 10-acre area. Number of different disposal options in the past, trench-and-fill style. Again, a great deal of material was removed. Most importantly, probably the ash from site 22 and some of the boiler ash that came out of there, it contained PAHs, residual explosives, compounds, 2, 4, 6 TNT, et cetera, and, of course, inorganics.

And the depth was variable. I think the deepest trenched area we uncovered during the removal action was approximately five feet.

Site 21, again a very small area east of site four. Primarily batteries, that's what we removed and disposed of those accordingly. Not much history on this site. It's one of those that we found as we were working on others, so there isn't a whole lot of information from a historical perspective on site 21.

And site 22, again it’s well-known that this is where they had burned ordnance, ordnance contaminated materials from the ‘40s. That continued until approximately 1995. Certainly there was not much burning at that point in time. There were a series of pans that were removed from that area, I think, in 1995, early 1996 before we began to build the biocell.

And, again, we did successfully treat soil from sites seven and 19 to sites that we do have records of decision in that biocell, so we believe that it was a very good project for us. It was certainly the first of our four As into innovative technology, like bioremediation and it certainly provided us with a number of lessons learned.

That’s just an aerial photograph to kind of give you some perspective on the location. I think we’re a little bit -- we have sites 21 and 22. This is site 22.

This is site 21 hiding back in the tree line here. And this is site four just north of site 22.

I’ll discuss in brief some of the

investigations. These are really put here to give some credibility to our decision-making process. We’ve been actively involved with these sites for a number of years now, dating back to 1984. And certainly before my time, Baker came on the scene then around 1992, 1993 during the FFA development. And so you can see that we’ve had numerous investigations at site four.

Site 21, again because it was found a little bit later on in the process, received habitat evaluations, subsequent and removal action, and then a post-removal report in ‘95. The round II RI is really what pulls this all together.

Site 22 investigations, similarly it did not receive a lot of the initial investigations because it was an active facility. But, again, sampling in the round II RI stage in 1996 -- and, of course, our pilot study where we did the simplot work.

Again, investigations that we really focused on as part of the round II RI and risk assessment was certainly the more recent data. I think the post-removal data was very important. And certainly the round I data that was collected by Baker and WPNSTA. And those were supplemented with additional soil samples and some groundwater data. That rounded off our round II RI.

I'll quickly go through the baseline risk assessment. In general when you conduct a baseline assessment we take our analytical data and then we identify chemicals of potential concern, and we do the same for ecological chemicals as well. And this is really a comparative process. We take our maximum detected concentrations in a given media and compare those to EPA criteria. If it concedes, it becomes a chemical of concern, either ecological or human health.

Then once we've done that, we begin to develop exposure pathways. These are the site-specific inputs that we evaluate and we try to, as best we can, determine how humans and receptors, ecological receptors, could be exposed to these contaminants. And these round up into a mathematical model to calculate risk. That risk assessment then provides us for the basis for taking any subsequent remedial action.

Some of the contaminants of concern, not surprisingly the explosives, the PAHs from the burning process and ash, and then, of course, inorganics, which we believe are the result of past practices.

Those inorganics with asterisks behind them indicate that there’s probably some background considerations meaning that station-wide background areas of unaffected soil, groundwater, surface water, or sediment may have similar concentrations. So those are chemicals going into the feasibility study we begin to discount, if you will.

The ecological COC are a little different because, again, you have more receptors to consider. In the ecological risk assessment process, we consider everything from the soil, macroinvertebrates, to plants, to flora, and fauna of all types really. And then we also do some food chain modeling to evaluate the effects on deer and the upper trophic levels. And so you get some different contaminants of concern, but these are pretty much similar to the human health.

Of course the TNT, the dinitrotoluenes are rather toxic, and so they make our list, PAHs and then, again, the inorganics.

Site 22, this was primarily the inorganics, and most of these were background with the exception being aluminum. One of the chemicals that was not background, aluminum. And the reason being is we believe this is associated with the ordnance that was burned.

To go over some of the baseline risk assessment results, from the human health perspective, we look at two indices, we look at the incremental lifetime cancer risks, which is the probability that if you are exposed, as our risk assessment says you might be exposed, you have this probability of developing a cancer over the course of your lifetime.

The next index we look at is the hazard index, and that’s really a go or a no go decision-making tool. It says if you are exposed to a chemical above a certain threshold, there’s the potential for an adverse effect. It doesn’t give you any indication of the severity or the magnitude of the effect, only that if you are exposed above this level, there could be an adverse affect.

At site four, we had some exceedences to future residents, and that’s because of the PAHs. In particular, the carcinogenic PAHs, benzopyrene -- there’s seven of them that we focused on. And these have the potential of causing cancer if ingested.

EPA region three does not like to look at the dermal exposure to these contaminants because of the pathways. In the risk assessment we do consider the ability of a contaminant to cause a certain effect by the pathway of exposure. And certain chemicals cause –- or are more likely to cause cancer by certain pathways. PAHs certainly by ingestion.

There is some indication that they can cause cancer through dermal contact. In fact, some of the earliest studies of carcinogenesis involve PAHs. But because of the toxicity factors and the way they are derived, EPA region three says we don't look at the normal pathway.

We also had hazard indices that exceeded one. And that was primarily due to arsenic. We had some very high hits of arsenic in the southern portion of site four.

Site 21, there was really no human health risk. Again, I credit the removal action for this. We took so many batteries out of that area and so much soil that I think what we had was the very residual of residuals.

Site 22, we were rather surprised. But given the nature of the disposal, it sort of made sense that because you're incinerating explosives, you probably hit some very high temperatures out there. Many of the organics were destroyed. We also did some dioxin sample of the site. I think we talked about that here a few meetings ago where EPA had requested that we look at the potential for the formation of dioxin because of the incomplete combustion processes associated with open burning as a means of disposal.

Again, we took those samples, we submitted them to a laboratory that performs the very high end dioxin analysis. It looked for all of the congeners of dioxins specifically. Very sensitive, very selective method, and we really found very low levels of dioxin, which we were very glad to find. We did not have the levels we expected to find at site 22. So, again, risks to human health at site 22 are rather limited as well.

Ecological is a little bit of a different story. Because we run the uptake models and because a lot of our ecological risk assessment is comparative in nature, there are those PAHs and inorganics which exceed not only background values, but EPA’s criteria, so we do have potential ecological risks at site four and both sites 21 and 22.

Based on the results of the risk assessment, what did we think we have to do in terms of remedial action at these particular sites?

Well, we came up with what we call the scope and the role of our remedial action. And really there were two most important points. One is to mitigate the potential for exposure to PAHs of site four. There is a human health issue there. We don't take an action that we believe should be addressed, so no action alternative fell out of our decision-making process of site four very quickly.

At site 21 and 22, it's a little different. Site 22, certainly there was the RECWA issues that are driving us to take a response action. Certainly we have to remove the biocell and restore the area, but there were also some erosion concerns that forced these sites up in the process.

In fact, we weren't going to address sites four, 21, 22 until later on in the program, but because of the erosion concerns and some of the RECWA concerns as a group when we began to partner on the issue, we decided to move it up.

And, in essence, we really need to clean-close the biocell and prevent the erosion of materials from site 22, adversely impact to Felgates Creek.

Based on that scope, we began to develop remedial action alternatives. We always evaluate no action because EPA requests that we look at no action as a baseline. But, again, that fell out of the process and out of our thinking very quickly.

The other alternatives we evaluated are

capping and ex-situ phytoremediation process that says we'll dig this stuff up and basically create these plots and pack the soil in these plots and grow certain types of plants. And by growing those plants, you'll uptake the contaminants, and then we can clean the soils that way by, in essence, harvesting the plants and disposing of the plants and then replacing the soil when the remedial action goals are reached.

That's a rather costly alternative. But it was kind of a creative way of looking at it. And it also fulfills the obligation that we have to look at treatment technologies.

RAA 4 is excavation of off-site disposal. It's not always preferred, but it certainly is a tried and true means of getting rid of the problem. What we hope is that we don't make it somebody else's problem down the line.

We looked at RAA 5, which is a soil washing technique. Again, it's rather expensive. You have to pick this stuff up and wash it, and so it's not as clean a process as it may sound.

We also looked at one other process based on a few comments that we received from EPA and I believe some other of our regulatory committee, and that was a stabilization technology where you come in, dig this stuff up, create a cement slurry, and put it in blocks and cover it up. I didn't think it was a very good way to go because the Navy is stuck with having to maintain at least a soil cover over the top of this. And it's pretty tough to grow the types of plants we want to get to regenerate on top of concrete.

Again, kind of going over the alternatives and looking at the costs and whether or not they would or would not be protected. You can see RAA 1, no action. It's certainly not protective, but it's easy to go. It doesn't cost you anything to do that.

RAA 2, the capping technology, again you have to maintain this cover, and the station is not in the business of maintaining landfills. So, again, when we look at capping, it's always an attractive alternative because of the cost, but we're always aware of the fact that we're not really taking care of the problem; we're sort of deferring it, if you will, to the future.

The ex-situ phytoremediation, again it was rather costly. We would have to harvest and collect some soil and build a plot and harvest the plants, take a look at a trend analysis to see if it was doing what it was supposed to. And $1,200,000 for the cost. It is one of the more costly alternatives we evaluated.

RAA 4, again these are estimated costs.

And, Scott, you could probably give me a better indication now of where we stand because we've begun the process of talking to ITOHM about the actual cost for this type of remedy. But we had estimated it to be around $980,000. Again, it's very implementable. It's certainly permanent because it's not something you have to worry about once we have taken it away.

The soil washing, again it's protective of human health. This says it's easily implementable. That's not necessarily true. Again, it's rather costly, about $1,600,000, and plus you have to deal with residual wastes, and there would be some other issues to concern yourself with as well with respect to implementation.

So what we propose tonight and what we're asking for public input on is our preferred alternative, which is excavation and off-site disposal. We believe it's better in terms of the long-term effectiveness than a cap and something the station doesn't have to worry with after remediation is completed, and it is certainly more implementable than either the soil washing alternative or the phytoremediation, and it is certainly more cost effective than either of those alternatives.

This is just giving you an idea of that site four where some of our little concerns are. And, again, because we had this removal action, you can see that our areas of contamination are rather small. This map is pretty large in terms of scale. But you can see that we have an area where the ash pile once was situated where we believe there's some residual contamination remaining. And then there were some areas of debris in the southern portion of site four.

This was the area where high arsenic was detected. These are the areas that we'll dig up and haul away unless there is a significant concern by the public or regulators that they would like us to look at some other alternative.

This is site 21. And it's sort of difficult to see the boundary of the site, but the wood line starts in this area. Anything to the left of that is wooded. And so what you have is a drainage area, and we believe that the contamination, which has probably just over time leached and eroded and have ended up down at site 21, and these are areas that we intend to excavate and dispose of off site. So, again, just some very small areas, the larger area in the southern portion section of site 21.

Once we do this and remove it, there will be no more risk for ecologic receptors and there will be no property use restriction at either of these, certainly 21.

Site 22, this is the footprint of the biocell. And you notice that we have actually added the extension of the biocell and the pad, the staging pad. So this is a fairly up-to-date drawing. There was an area of erosion that was repaired on the western portion of the site. The eastern portion of the site is where we dewatered. And there was a large earth and dam that was breached in order to really to release the water that had collected in over time.

So this -- the biocell will be removed and disposed of accordingly. There will be sampling conducted to make sure there’s no residual waste material under the biocell, and then this entire area will have to be regraded and vegetation established accordingly.

These are a little optimistic in terms of the dates. The final ROD is due March 30th. We’re trying to push this so we can get into the field of the optimum time. Talking to Jeff and having worked a little bit yesterday at site 17 with the natural resource folks, it’s always imperative that we try to get any sort of cover or new vegetation established at the best time of the season. So the earlier we can begin the process of remediation, the more time things have to establish themselves before the dry weather gets here or before the winter.

The public comment period began January 21st. We posted the newspaper announcement in the Virginian-Pilot, and it closes March 6, 2001. But I don’t think that anybody should consider these hard-and-fast deadlines. These are really regulatory in nature, and I’m sure Jeff and Scott will address any concerns the public may have at any time.

That in a nutshell is the proposed remedial action for sites four, 21, and 22, and we’d be glad to take any questions you might have at this time.

MR. MOSS: Could you explain what happens to the soil after it leaves the gate, please?

MR. HARLOW: Well, I guess the cheapest is the best. And in the reality sense -- we try to minimize -- maybe just to stress up front, if there’s a lot of debris, we’ll separate it out best we can.

But if there's an actual waste, nonregulated, it will go to a certified landfill within basically the area.

Fortunately -- maybe one of the things, I guess, Rich didn't explain on this is a couple of things, one, try not to be in the business of a landfill. I guess we do have a philosophy if it's four or five acres in size, we have it, we're stuck with it, and we'll deal with it. This is very small items of removal, and a lot of it is trash in concurrence with PAHs or whatever, so it's like a mix-type waste. There's not really any kind of hazardous waste, per se. It's more of a solid waste. And, unfortunately, there's no technology out there ready to deal with it in that sense, so we're basically stuck having to go to the landfill with it.

Generally, over the years, it's been chambers -- and you might be able to jump in, too, Steve.

MR. MIHALKO: Generally, the state's solid waste regulations, there's only certain landfills within the state that are authorized to accept special wastes. Special wastes come from super fund sites. These are pretty much state-of-the-art landfills with liners and so forth. I believe there's three in this state that are authorized to accept it.

MR. MOSS: So your problem becomes their problem after it leaves the gate?

MR. MIHALKO: I wouldn’t call it a problem.

MR. MOSS: Monitoring and that kind of thing with the soil.

MR. MIHALKO: I wouldn’t really call it a problem. They are designed to accept that kind of waste.

MR. HOFF: I guess, Barry, a way to look at it is that these are facilities that are designed to accept this type of material. And certainly they are managed and regulated accordingly; whereas, if we were to establish a number of capped areas on the station, the protectiveness really only applies to -- insofar as the station maintains the cover.

So I think that while certainly as we go through the feasibility study, we consider the short-term effectiveness. And part of that is knowing that we have to dig this up and it creates dust and we’re going to put this in trucks, the trucks are going to have to leave the gate, as you said, and dust is always an issue with trucks moving in and out of the facility, and then certainly the final disposition of the material and where it will be disposed.

We do sample to determine whether or not the material is hazardous or nonhazardous, and that dictates as to what landfill the material would reside.

MR. MOSS: Will your costs include their costs of monitoring it forever, or do your costs end and theirs start?

MR. HOFF: In a sense it does because they build that into the cost per ton that they charge us.

MR. HARLOW: I mean, there is the risk that 30, 40 years from now, there may be some problem in that we may have to go back as a potential responsible party or whatever. And that's kind of the risk we are taking unfortunately. And like Rich says, the problem that we have is we're not in the business to manage landfills. Whether that's good or bad –- I mean, with it being small areas -- for me, I won't be there for forever.

And at some point I can almost assure you that because there's always little pockets of landfills, if that's what we ended up with, they would become poorly managed; whereas, the state can properly manage three or four within the state, I guess, and that's basically what it is. That landfill is in the business of managing that waste, and that's what they do.

MR. MOSS: But down the road sometime, if there's a problem like a landfill, they will look at all of the people that put stuff in there and, you know, share the problem with you.

MR. HARLOW: Yes.

MR. HOFF: Correct. And that's one of the reasons that we do try and minimize what we send off to the station. Because certainly for hazardous waste, it's a cradle-to-grave ownership that the station has, and it's why they manifested this waste when it goes to certain hazardous waste material landfills.

It's not something we like to do. But when you look at all of the alternatives, it's probably the best alternative at this time.

MR. MOSS: Yeah. Probably this stuff is a lot better than some of the other things you have sent to landfills in the past?

MR. HOFF: We joke about it. We think a lot of what we send them ends up as clean cover in a lot of respects.

MR. MIHALKO: A lot of time they use it for daily cover.

MR. HARLOW: They still charge us for it, but they are benefiting from it.

MR. HOFF: Again, I think we take a very aggressive position when we remediate based on ecological concerns. Because, again, we're looking at the individual, and there are a lot of ecological risk assessors that say, that's not the way to do it; you have to look at the effects on the population.

The problem is, how do you define an effect on population in 16-, 18-, 24-month time period? It's almost impossible. So we do err on the side of conservatism by taking that material out and treating it on-site as we have in biocells in the past or by sending it to the appropriate landfills.

Yes, sir.

MR. HAVENS: In removing this soil, site 21, what depth is the soil removed in general?

MR. HOFF: For this site -- for these three sites, it will be rather shallow. We'll go to two feet.

MR. HAVENS: Two feet?

MR. HOFF: Yes, sir. We have determined that for site four and for site 21 the depth of contamination is in the top two feet of the soil horizon. That's what we intend to get.

MS. PHILLIPS: And determined how far the contamination goes down?

MR. HOFF: Correct. In site 22 it might be a little different because when we sample under the biocell, if we find material under the biocell, we don’t know how deep that might be. So we’ll have to confirm as we dig there because, again, given the RECWA issues surrounding the biocells, we have to remove that to be protective of human health at all levels. So that’s what’s known as a clean closure under RECWA. And that’s what we’re shooting for at site 22; that would be clean closed.

MS. PHILLIPS: Do you add new soil as you remove it to the same depth as the contour?

MR. HOFF: Yes, we intend to use fill from the on-station borrow pits, and then we’ll purchase topsoil as we need it to reestablish the vegetation. Hopefully, we can grade it to get it back to as natural a contour as it once was.

MR. HARLOW: Most of this is highland specific to these sites. I mean, where it’s feasible to reclaim wetlands, we take that into consideration, too. Most of the areas you see here are way up, they are several, like tens of feet above sea level. So there’s no impact really to the wetlands.

I'll back up and say at the bottom of the trench line of the site 21, between site 21 and 24, we may look at doing something of a pseudo regrading, and if we feel like it's more beneficial to the ecological to leave whatever we've cut out and put maybe some topsoil, we do consider that. It's usually field determined.

We'll bring fish & wildlife in and discuss it if it's feasible. Generally, as a rule, we look at backfilling to original grade, so we do change as we go along the sites and try to be smart about it.

CAPTAIN SKUDIN: Bouncing around a little bit, talking to some of the archeologists that have discovered that almost everywhere you dig on a station, you go through a topsoil layer that's rather thin, a sand layer, and then you get to this clay. And you can pretty well tell where it's been dug out. And it's going to drain along the top of that clay, so it's not all that hard to figure out.

MR. HARLOW: The two foot is a baseline, too. If there's contamination, we do confirmatory sampling under the construction end. And if we still are chasing it, whether it's a physical notice of staining or whatever or a confirmatory sample showed further contamination, that two foot could go to four foot. It's not going to just cut off at two foot because that's what we said we'd do.

MR. HOFF: Again, when we do a feasibility study, we have to make some very broad assumptions about the nature of the waste, and it's something we're working with and working together on as a team to better address the nature of contamination and waste material at the station.

In the past we've always surprised the remediation contractor. We give them these drawings and they go out in the field and the stuff isn't where we say it is, or if it's there, there's a lot more of it. So we're getting a little smarter on that and working more closely with John Dorm.

And you'll begin to see this at Cheatham Annex where we're actually learning from our past mistakes. I wish I could say the process was perfect, but we learn as we go on this. We're going to try not to make the same mistakes twice. We're going to begin to look more aggressively with more invasive means of investigation. We're going to use a lot of trenching and a lot of digging, active digging as opposed to sampling which from an environmental prospective gets you good environmental data, but it doesn't tell you anything about the site that you might have to remediate.

So I think there's some very exciting things happening as we move into Cheatham Annex. We have had the opportunity to really learn our lesson at Weapons Stations Yorktown. And I think that when you see some of the projects that we intend to undertake at Cheatham, you'll be very impressed because we are looking at returning natural grades, establishment of wetlands, and hopefully not doing as much off-site disposal as we may have in the past. We can't always promise that, but we'll try to really apply the concept of biological approaches to biological problems.

Any other questions?

Thank you for your time.

MS. PHILLIPS: This concludes the public portion part of the meeting, so we're going to take about a five-minute break, five to 10 minutes, stretch your legs, and then we'll come back and let Jeff give some updates.

(Hearing adjourned at 7:45 p.m.)

COURT REPORTER'S CERTIFICATE

I, SCOTT D. GREGG, RPR, and Notary Public, certify that I recorded verbatim by Stenotype the proceedings in the captioned cause, in Lackey, Virginia, on February 21, 2001.

I further certify that to the best of my knowledge and belief, the foregoing transcript constitutes a true and correct transcript of the said proceedings.

Given under my hand this 6th day of February, 2001, at Norfolk, Virginia.

Scott D. Gregg